Instruments

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SPECIAL ISSUE · · IN TWO PARTS · · PART ONE

Speeding Up National Defense THROUGH Instrumentation

IN THE SERVICE OF NATIONAL DEFENSE

BECAUSE of the contribution TAG has made in automatic control, practically every Industry engaged in America's National Defense Program operates more effectively . . . and, with greater precision, more speed and less waste. More than 160 years of thermometer making live behind the TAGliabue name. . . . Nearly half a century of service to Industry sponsors its scores of Indicating, Recording and Controlling Instruments for temperature, pressure, time, level and flow.

These traditions and achievements in the past serve only as a spur today in anticipating and meeting Industry's needs for increasingly effective Instrumentation.

As a primary function of all Instrumentation, TAG recognizes this national emergency and has geared its thinking, research and resourceful development energies to meet it promptly.

Below are listed some of the many TAG Instruments now in service in National Defense Industries.

TAG PRECISION INSTRUMENTS OF TOMORROW - READY FOR INDUSTRY TODAY

TAG INSTRUMENTS FOR THE PLANT

BAROMETERS
- Mercurial

CONTROLLERS
- Flow
- Humidity
- pH
- Liquid Level
- Pressure
- Temperature
- Vacuum

DIAL-INDICATING THERMOMETERS

FLOW INSTRUMENTS
- Controllers
- Indicators
- Integrators
- Meters
- Recorders

GAGES, RECORDING
- Pressure
- Temperature
- Vacuum

HYDROMETERS

HYGROMETERS
- Wet & Dry Bulb Thermometers

LIQUID LEVEL
- Controllers
- Indicators
- Recorders

MERCURIAL GAGES
- Absolute Pressure
- Mercurial Vacuum

MOISTURE METERS, Electric, for instantaneous moisture determination of Wheat, Corn, Barley, Other Grains and Seeds; Tobacco, Wood and Miscellaneous Granular Material

POTENTIOMETERS
- Controlling
- Indicating
- Recording
- Self Balancing

PYROMETERS
- Controlling
- Indicating
- Recording
- Resistance
- Thermoelectric

PSYCHROMETERS
- Recording

RECORDERS
- Electric
- Flow
- Humidity
- pH
- Hygrometer
- Liquid Level
- Pressure
- Temperature
- Vacuum

REGULATORS (See Controllers)

STEAM TRAPS

THERMOMETERS
- Chemical
- Dial
- Electric
- Expansion Stem
- Indicating
- Industrial
- Recording
- Resistance

TIMERS
- Time-Operation Recorders

VALVES
- Diaphragm
- Automatic Safety Shut-Off
- Reducing
- Pressure
- V-Port
- Three-Way
- Water Circulating

TAG INSTRUMENTS FOR THE LABORATORY

- Acid Heat Test Apparatus
- A.P.I. Hydrometers
- Asphalt Testing Apparatus
- Barometers (Mercurial)
- Burning Test Apparatus
- Carbon Residue Apparatus
- Centrifuges, Laboratory
- Centrifuge Tubes
- Cloud & Pour Test Apparatus (Cold Test)
- Colorimeters (Light Oils and Lubricating Oils)
- Cylinders, Graduated
- Cylinders (Hydrometers)
- Dew Point Apparatus
- Distillation Apparatus (Gasoline, Kerosene, Gas Oil)
- Emulsification Apparatus
- Flash & Fire Point Apparatus
- Flasks, Viscosity
- Fuel Oil Testing Apparatus
- Grease Testing Apparatus
- Gum Test Apparatus

HYDROMETERS
- Acid
- Alcohol
- Alkali
- A.P.I.
- Baumé
- Calcium Chloride
- Glue
- Milk
- Petroleum Products
- Salt
- Sea Water
- Sugar
- Syrup
- Tanning Liquors
- Turpentine
- Wort

- Hygrometers or Wet & Dry Bulb Thermometers
- Jars (Hydrometer)
- Laboratory Apparatus & Supplies
- Lactometers
- Meters, Moisture
- Oil Testing Instruments
- Penetrometer
- Rods, Gage
- Saccharometers
- Samplers, Oil
- Saybolt Testing Apparatus
- Sulphur Test Apparatus
- Stop Watches, Mechanical
- Stop Watches, Electrical
- Testing Apparatus, Oil
- Testers, Oil
- Testers, Flash Point

PYROMETERS
- Controlling
- Indicating
- Recording
- Resistance
- Thermoelectric

THERMOMETERS
- Chemical
- Cup Case
- Electric
- Industrial

- Thermostatic Viscosimeter
- Timers, Operation
- Tubes, Centrifuge
- Vapor Pressure Apparatus
- Viscosimeters, Saybolt
- Wax Melting Point Apparatus
- Water & Sediment Apparatus
- Wet & Dry Bulb Thermometers

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CLEARANCE SALE

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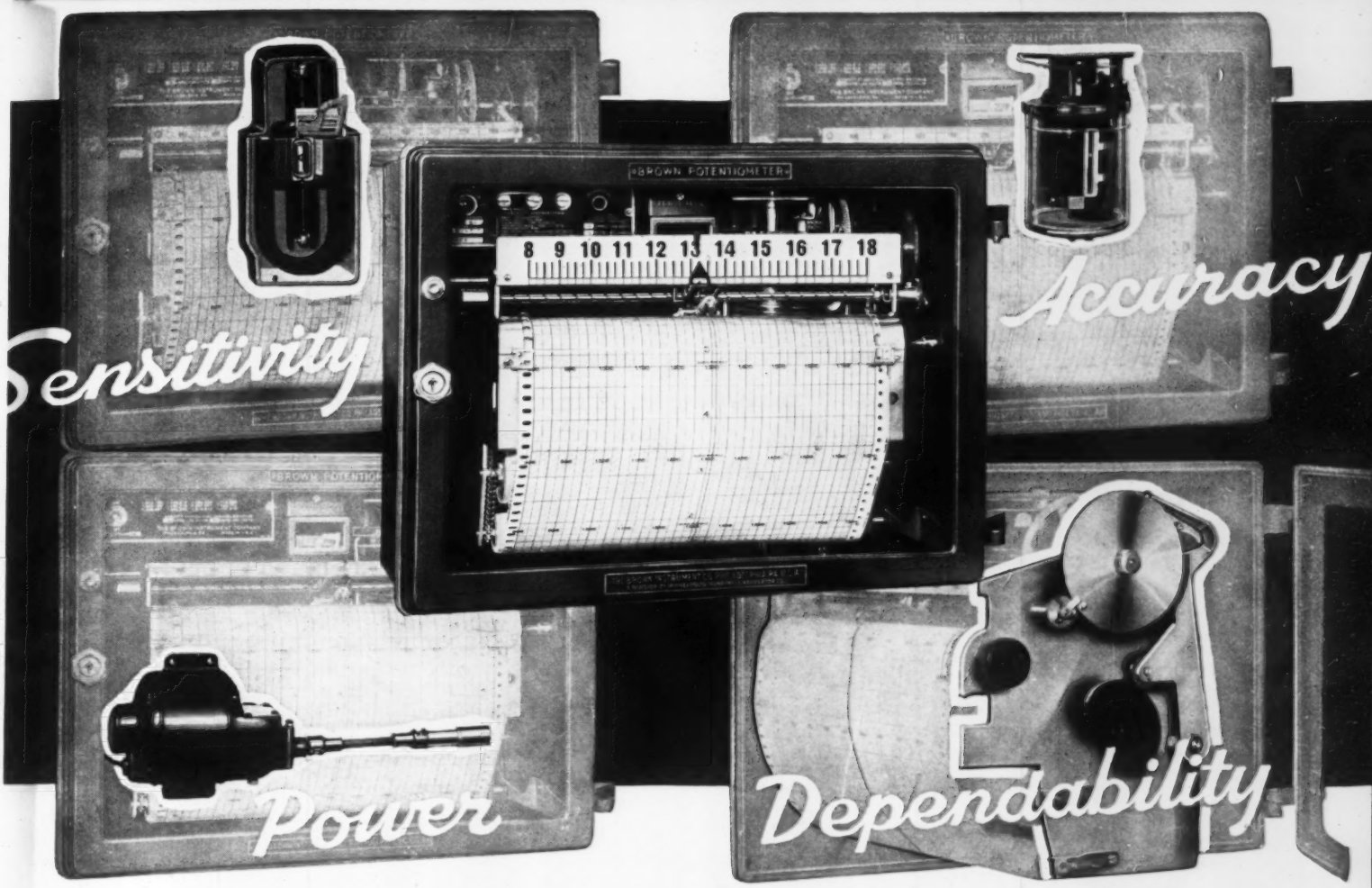

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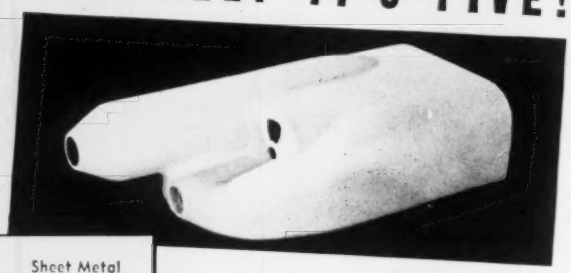

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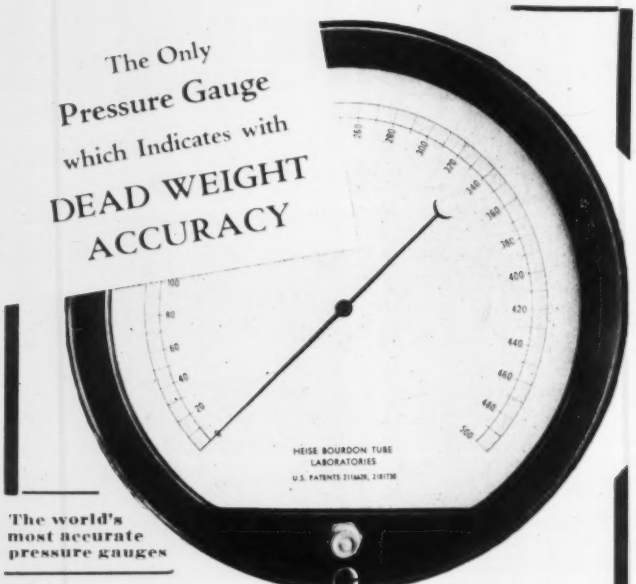

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Instruments
THE MAGAZINE OF Measurement and Control

Vol. 14 JANUARY 1941 No. 1

SPECIAL ISSUE—IN TWO PARTS
(Part Two, bound separately, is *The 1941 Instruments Index*)

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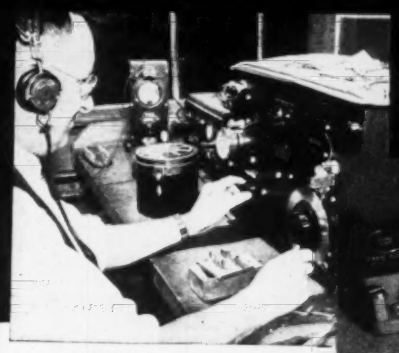
PRECISION APPARATUS



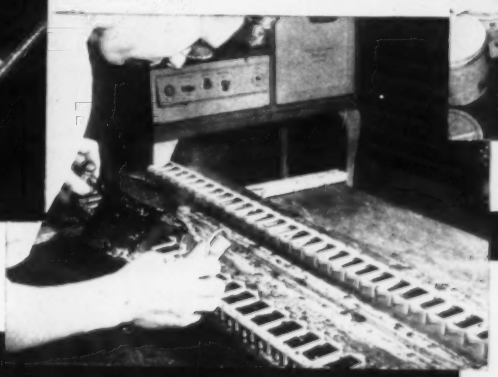
After assembly the units are aged for three heat cycles and placed in a desiccator between cycles; they are then calibrated and aged again for three cycles.

Assembly in the Bakelite case is composed of a bottom layer of silica gel, a blotting paper pad, the condenser unit, and ground cork.

A precision mica condenser in the making: low-loss bakelite case, heavy brass end-plates; heavy spring pressure-plate; selected India mica; tin foil; blotting paper; silica gel; ground cork; Ozite sealing compound; leads; assembly screws.

During assembly all parts of the condenser are maintained at 300 degrees F to drive out all moisture; the workman has a glass shield between his face and the condenser parts to hold the heat from the electric hot-plate upon which the condensers are assembled.

(above) The condensers are then sealed in a special Ozite compound mixed to give the proper relation between adhesion and melting point.



(at left) After the compound has cooled a final layer is poured on and sealed to the sides of the case with an alcohol torch. The condensers then are tested for breakdown at 2,500 volts d.c. In the calibration laboratory, they are finally checked for capacity, power factor and d-c leakage.

SEVERAL years ago General Radio assigned an engineer to investigate the design of small fixed condensers having sufficient stability and low losses for use in precision circuits such as beat-frequency oscillators, bridges and standard-signal generators.

After a number of months of research, the Type 505 and Type 509 Condensers were developed. While designed primarily for use in G–R instruments, hundreds of these condensers have been sold separately for precision circuits and apparatus.

In the Type 505 and 509 Condensers selected India mica is used, each piece being carefully inspected for scratches and other mechanical defects which cause high dielectric losses. Mica, despite its excellent dielectric properties, is fairly high in its moisture absorption characteristics, a property which adversely affects its power factor. In these condensers the mica and its associated tin foil are kept at a temperature of 300 degrees F for a considerable time before the condensers are assembled, during assembly, and thereafter until sealed.

To keep the condensers dry after assembly, they are placed in a bakelite case with a mixture of silica gel and ground cork and are then sealed with an Ozite compound. The amount of desiccant sealed in is such that there can be 2,000 complete changes of air due to leakage before the desiccant will be used up.

Changes in pressure can cause appreciable changes in capacitance. In these condensers the stack is heavily loaded with a stiff spring under considerable tension to a point where the change in capacitance with pressure is very small. During the assembly process, each unit is carefully aged through a number of heat cycles to increase stability.

The resulting characteristics are such that these condensers make admirable secondary standards of capacitance and are of such physical form that they are readily adapted to use in precision measuring instruments. All Type 505 units are adjusted within 1% or 10 $\mu\mu$f whichever is larger and Type 509 units within ¼%; the temperature coefficient of capacitance is less than +0.01% per degree C between 10 degrees and 50 degrees; the power factor of almost all of the units at 1,000 cycles and 25 degrees C is less than 0.05%; the leakage resistance in most of the units is greater than 100,000 megohms. These condensers are available in standard capacitances from 100 $\mu\mu$f to 1 μf at prices between $3.50 and $48.00. GENERAL RADIO COMPANY, Cambridge, Massachusetts. Branches in New York and Los Angeles.

Since 1915 Manufacturers of Precision Electrical Laboratory Apparatus

Tiny changes in temperature, so small that you can see them on the chart only with a magnifying glass, are more than large enough to start Micromax control action. And correction of the change starts when recording starts . . . doesn't wait till a change is recorded. That's one reason for extreme steadiness of heat under Micromax Control.

You Would Need A Glass

To See What A Micromax Pyrometer "Sees"

Suppose you were regulating the heat to a furnace, by hand, using a Micromax Pyrometer's record as a guide.

Every time, then, that Micromax showed you a change in temperature, you'd turn the valve or damper. After a little practice, you'd keep the temperature quite uniform.

But, unless you held a reading-glass to the record, you couldn't keep the same uniformity that a Micromax Pyrometer keeps when it automatically operates its own valve-drive. For without the glass, you couldn't see changes as soon as the instrument "sees" them. And you couldn't respond as quickly and accurately as the instrument responds.

The reason is summed up in the "micro-responsive" balancing unit of Micromax. This vital unit, the unique product of a quarter-century of development, responds *early* to each tiny deflection of the instrument's temperature-driven pointer. It allows no clearance—no space through which the pointer can move before its motion causes corresponding motion of the valve. The effect is as responsive as though the pointer acted snugly and directly on the valve. Temperature changes are headed off with a smooth efficiency that sets new standards for automatic control.

See Catalog N-00A for models and other information.

Broaching Tools Get Precise Heat-Treatment When 3 Rayotubes "Gang Up"

When a broaching tool is nearly 7 feet long and only 6 inches thick, and is made of high-speed steel, here's the way Lapointe Machine Tool Company controls heat-treating temperature to secure uniformity in spite of the tool's sylph-like figure.

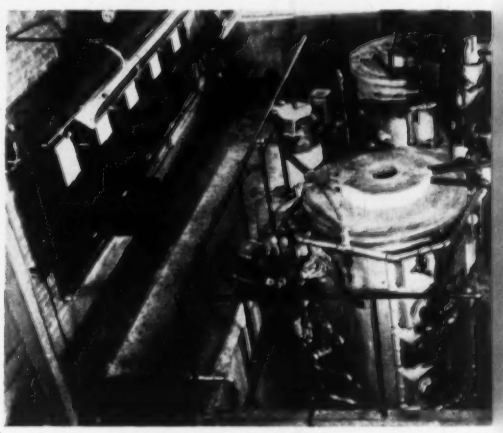
The broach, suspended by one end, is preheated in a 12-inch-by-84-inch Stewart vertical muffle furnace. After preheating, it is transferred to a similar "superheater" furnace, for the higher heating which hardens high-speed steel.

Both these furnaces burn vaporized fuel oil, regulated by Micromax control pyrometers which act through Micromax electric valve drives. The difference between the two control systems is in their temperature-detectors; the preheat furnace uses three thermocouples, while the superheat unit uses three Rayotubes.

Rayotubes are our comparatively new radiation-type detectors. They are far more responsive and longer-lived than couples, at temperatures above 2000 F, and they thus enable Lapointe to secure advanced, dependable control at the higher temperatures, where, of course, the critical heating is done.

Located at top, center and bottom of the furnace, each Rayotube "reports" to a Micromax pyrometer, which opens or closes four valves as may be necessary to hold the long, thin broach at temperature. So complete, agile and entirely automatic is this control that heating is not only highly uniform but is reasonably rapid . . . an especial advantage at present.

Controls of the same types are being applied to other industrial furnaces . . . batch type and continuous. Write for Catalog N-00A, which describes the various Micromax models.



Above—Lapointe Mach. Tool Co.'s heat-treat for speed broaches.

Below—One of the Micromax Pyrometers, and its tube, in the Lapointe heat-treat.

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MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

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Instruments THE MAGAZINE OF Measurement and Control

M. F. BEHAR, Editor

Defense WILL Be Speeded Up

IN mellow years of peace, when no cloud threatens national security, all kinds of inventions and schemes can be considered: an evidently half-formed plan may evolve into a major strategic advantage in the more or less distant future.

But in times of dire emergency it is the present that counts: the most valuable ideas are those which are immediately applicable. With the specific intention of bringing to light a number of such ideas, *Instruments* announced last July that the theme of the Third (1940) Annual Instrumentation Contest would be "Speeding Up National Defense Through Instrumentation." On this page last July, the initial announcement was in the form of an explanatory editorial entitled "Ten Million Man-years"—referring to the production task facing American industry.

That was six months ago. Today, the seventeen billion dollar preparedness budget can be translated into fourteen million man-years. Since the number of men actually engaged is far from fourteen millions, since production involves innumerable sequences from raw materials to finished products, and since a number of facilities where men are to be employed on defense production are yet unbuilt, it would seem that instead of fourteen million men working during one year and finishing the job in early 1942, it will be a case of an average of six million men working for more than two years and completing most of the job toward the middle of 1943. When we declared on this page that the answer is "Speed, Speed and more Speed," we were still thinking of ten million man-years, not fourteen. The need for instrumentation—especially *automatization*—has grown even keener!

Perhaps the best thing about the words "through instrumentation" in the theme of the contest is that they limited the ideas to those which are immediately applicable. Instruments, meters, automatic control systems, automatic inspection set-ups, etc.—these are not factories to be built, wells to be drilled, mines to be dug: they are readily-available products. Even an entirely new "instrument" or "automatic system" is in most cases made up of readily-available components.

On the whole, therefore, *Instruments* may pride itself upon this special issue containing practical ideas. The credit, of course, should go to the contestants themselves. Their ideas are ready for immediate adoption by numerous establishments engaged in defense production. In one respect, however, *Instruments* may claim a little credit. The preceding contests had been open only to instruments users; employees of instrument manufacturers were excluded because the prize money had been donated by instrument firms. This third contest was open to "all persons except employees of the Instruments Publishing Company or their relatives," because the $500 prize money was donated by this company. Result: Some excellent ideas submitted by employees of instrument manufacturers.

The thanks of American industry should be extended also to Captain Hanson, Lt.-Col. Guion and Messrs. Pigott and Rieger who patriotically donated their services as Jurymen.

The contest is over only in an official sense. It is just beginning to operate now, with the publication of this special issue. The aim was not so much to reward men with valuable ideas—it was to have these valuable ideas presented in such a way that they will be adopted. The rest is up to the readers* of this special issue. *Instruments* and the Jury of Award can call it a day; but the adoption of the ideas is in the hands of American industry. These are competent hands. Defense WILL be speeded up.

* * *

On the next page there is an official report of the Jury of Award. To this impersonal report your editor desires to add a postscript. I was disappointed in not seeing, among the entries, any description of an inspection or gaging "robot"—because automatized inspection has been a particular concern of mine for eight or nine years in connection with my Army assignment. I know from personal experience that there are thousands of human inspectors in the employ of the Army, Navy and private industry, who could be released from their repetitive drudgery—and should be! Without speaking for the Jury of Award or for *Instruments*, I state it as my own opinion that the **MOST** valuable ideas for speeding up production of Army and Navy ordnance matériel are summed up in two words: "automatized inspection." If you don't agree at first, look up and study the special feature article, "Inspecting Parts at Ford Plant," in the July 1936 *Instruments*.—MFB

*Including Defense officials not regular subscribers, to whom copies will have been mailed.

PLENARY SESSION OF THE JURY OF AWARD, THIRD ANNUAL INSTRUMENTATION CONTEST, NOVEMBER 25, 1940

RALPH T. HANSON	R. J. S. PIGOTT	M. F. BEHAR	EARL C. RIEGER	JAMES L. GUION
Captain, U. S. Navy Navy Department	Pres. Am. Society for Measurement & Control	Major Ord. Res. Ed. *Instruments*	Pres. Chicago Soc. for Measurement & Control	Lt.-Col., U. S. Army War Department

Report on Third Annual Instrumentation Contest

Sponsored by The Instruments Publishing Company. Theme, "Speeding Up National Defense through Instrumentation"

IN compliance with the Announcement and Contest Rules promulgated in August 1940 (and amended in October 1940 with regard to the closing date) the Jury of Award met on Monday, November 25, 1940 in the office of the Pittsburgh Ordnance District, War Department — by courtesy of Lt.-Col. Guion, District Executive Officer. All members were present.

Representing Mr. Richard Rimbach, Conductor of the Contest (who was out-of-town) Mr. William Scoltock of the Instruments Publishing Co. delivered to the Jury all entries received at the office of the Conductor up to the official closing date (Nov. 23). All had been uniformly bound in 9x12 folders, each folder bearing only the number of the entry. These were as follows:

1196	2381	8218	10759	23514
1453	2421	8502	10768	23916
2028	2443	9039	15126	23939
2204	4381	9061	15629	23943
2363	4491	9205	19040	23966
2364	7902	9206	19065	28056
				30161

Mr. Scoltock also delivered to the Jury another package, containing the thirty-one sealed envelopes, each numbered and enclosing the name and address of the contestant. He also delivered "individual score sheet" blank forms prepared by the Instruments Publishing Co. for the convenience of the Jurymen.

First business was discussion of methods of grading: Rules of previous Contests had specified percentage points for "pertinency," "originality," etc., but this time the Jury was not thus bound.

Captain Hanson proposed a method of assigning relative and tentative grades in the course of the first reading. Adopted.

Col. Guion suggested keeping records of all grades assigned. Adopted.

Mr. Pigott proposed a totalizing method for classifying entries as the work goes on. Adopted.

Various paragraphs of the Contest Rules were studied closely. Result of discussion was unanimity of interpretations.

Mr. Rimbach, Contest Conductor, telephoned from out-of-town, expressing his regret that other duties kept him away. He was assured that all Jurymen were in perfect agreement on the Contest Rules.

The first phase of the judging consisted in all entries being read, roughly graded, and initialed, by all Jurymen. At the conclusion of this work, all folders were examined to verify that each bore five initials. Then a preliminary check of the tentative grades was made. Result, twenty-two entries selected for the "Semi-finals," and nine put aside. All of these twenty-two entries were passed around again, so that each Juryman might revise his original tentative gradings of the first few entries he had read, in the light of his having read all thirty-one.

Tentative totals were compiled. The sixteen entries which had been given relatively high ratings by at least one Juryman were kept, as "in the running."

The sixteen "in the running" were given their final readings and their final *ratings* on the Jurymen's "individual score sheets."

When this work was completed, the mathematics of determining final standings was discussed, because different well-known systems give different final standings in cases of near-ties. The method finally adopted was somewhat as follows:

Since the prize money donated by the Instruments Publishing Co. is $500

to be divided as follows:

First Prize	$200
Second Prize	$100
Third Prize	$ 50
Four Fourth Prizes of	$ 25
Five Fifth Prizes of	$ 10

and since there are five Jurymen, each Juryman has one hundred "dollars" to distribute—forty "dollars" to his choice for First, twenty "dollars" to his choice for Second, ten "dollars" to his choice for Third, five "dollars" to *each* of his four choices for Fourth, and two "dollars" to *each* of his five choices for Fifth.

There being no adding machine in the room, Mr. Pigott volunteered as "lightning calculator" and was given a rousing vote of thanks.

Final Standings

First Prize: No. 4491 (145 "dollars")

Second Prize: No. 10759 (102 "dollars")

Third Prize: No. 2204 (39 "dollars")

Fourth Prizes (listed here in *numerical* order): 10768, 19040, 19065, 23966.

Fifth Prizes (in *numerical* order): 2443, 4381, 9039, 9205, 15629.

Honorable Mentions—the remaining ten in the twenty-two "semi-finals" (in *numerical* order): 1196, 1453, 2028, 2363, 2364, 7902, 8502, 9039, 15126, 23916.

In the opinion of the U. S. Army and U. S. Navy representatives, the twelve prize-winning entries and the ten Honorable Mentions could all be published without risk of divulging secret National Defense information. [*Note*—The twelve prize-winning entries are all published in this issue of *Instruments;* others receiving good grades may be printed later.]

Major Béhar was instructed to gather all individual score sheets and other "mathematical" sheets, have them checked, prepare the official report of the Jury, notify the Conductor of the Contest, and wind up remaining details.

Upon opening the sealed envelopes it was found that [as in the two previous Contests] entries had been received from a wide diversity of industries and of geographical locations.

R. T. HANSON
J. L. GUION
R. J. S. PIGOTT
E. C. RIEGER
M. F. BEHAR

Mr. Dupen was born in 1904 in Cornwall. He is a descendant of Richard Trevithick, famed as the inventor of the Cornish boiler and as the builder of the first locomotives for passenger service. Mr. Dupen was educated at Weymouth College and took both civil and mechanical engineering at the City and Guild of London Technical College. After working for the Gnome and leRhône Engine Co. he went to India in 1925 where he first did civil engineering contracting and later was in charge of automobile assembly and commercial body building for the South Indian distributors of General Motors products. He joined Bristol's Ltd. in 1935. Author of Institute of Fuels paper on industrial temperature instrumentation.

Fortunately for this write-up, George Gaites, now Pittsburgh District Manager of the Bristol Co., was with Bristol's Ltd. in England in 1935 and '36. Mr. Gaites helped us expand a brief cablegram into the preceding paragraph and added that Mr. Dupen became sales engineer for the English Bristol Co. in August 1935 and Sales Manager in January 1936 (when Mr. Gaites himself became Managing Director).

As we go to press, the portrait of Mr. Dupen, for which we had written by air mail in November, has not yet been received but—again fortunately—Mr. Gaites happened to have a Dupen family group snapshot, a portion of which has been enlarged to make the accompanying portrait.

Increasing by 80% the Output of Steel Annealing Furnaces

Awarded the $200 First Prize in the Third Annual Instrumentation Contest

By V. C. DUPEN

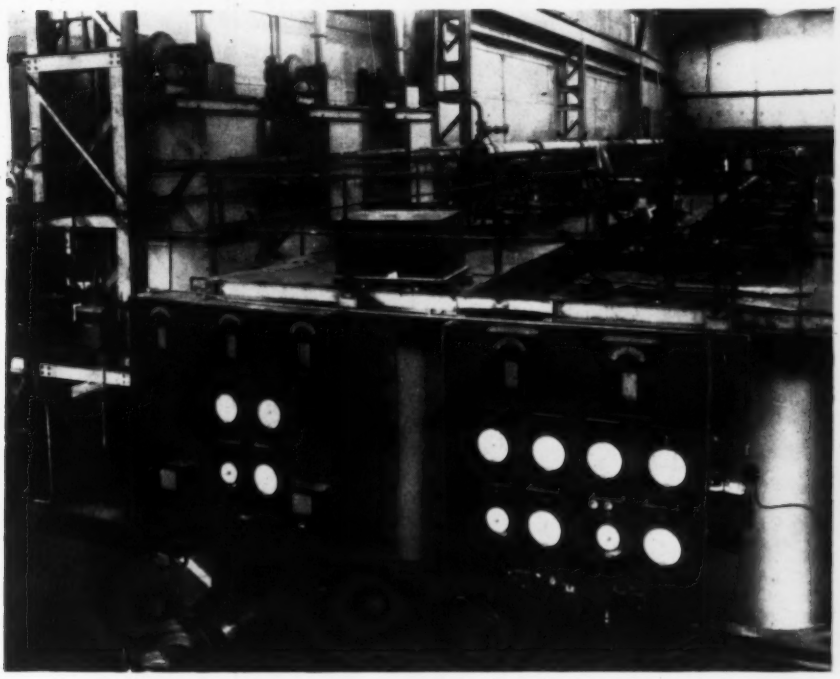
Sales Manager, Bristol's Instruments Co. Ltd., West Twyford, England

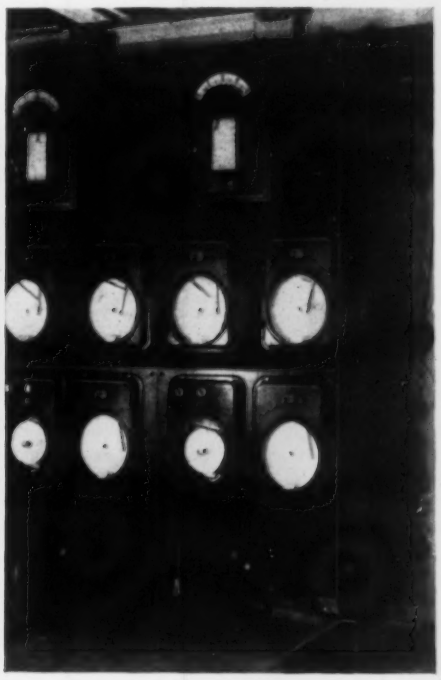
HEAVY demand for increased production and greater uniformity of product of bright annealed steel strip and wire led to an examination of the control problems surrounding the annealing furnaces used by Guest, Keen & Nettlefolds of Cardiff, S. Wales. The furnaces concerned were of the Grunewald type to the design of the Morgan Construction Co.; they consisted of two cells, each containing a charge supported by heat-resisting metal straps and enclosed in a sealed heat-resisting pot, one cell being used for preheating a charge and the other for bringing a charge to annealing temperature.

The firing of the furnace was accomplished by cold blast-furnace gas and recuperator heated air, having burners placed in a muffle around the annealing cell with the products of combustion led around the preheating cell to the stack.

The object in view was to raise the charge in the annealing cell to annealing temperature in the shortest practicable time and, simultaneously, to bring to as high a temperature as possible the charge in the preheating cell, consistent with keeping within safe limits of the furnace and the heat-resisting straps supporting the load.

The control of these furnaces was previously accomplished by means of an on-and-off potentiometer controller. By reason of this on-and-off operating characteristic, the flame length was constantly varying, making the heat in-





Left—General view of three two-cell furnaces and three sets of co-ordinated instruments. *Right*—Close-up of instrument panel. Note that for each furnace there are two potentiometer recorder-controllers, a program recorder-controller (twin-instrument), a cycle controller (bottom) and a recording flowmeter (top).

LEGEND OF OPERATIONS*

The cycle required for *program control cam No. 1* is as follows:—

Lower temperature from 880°C. to 780°C. in 56 min. with a sharp drop at the end of the fall of not more than 20°C. (less if possible), to give a positive operation of the Burgess switch being operated by cam follower; rise immediately from 780°C. to 880°C. in 2 min. Hold at 880°C. for 2 min.; lower from 880°C. to 780°C. in 56 min., again with sharp drop at end of fall. Rise immediately to 880°C. in 2 min.; hold at 880°C. for 2 min. Total time 2 hours. (Summary: two 1-hr. periods.)

Program control cam No. 2:—

Lower temperature from 880°C. to 780°C. in 36 min., with sharp drop at end of fall. Rise immediately from 780°C. to 880°C. in 2 min. Hold at 880°C. for 2 min. Lower from 880°C. to 780°C. in 36 min., again with sharp drop at end of fall. Rise immediately from 780°C. to 880°C. in 2 min.; hold at 880°C. for 2 min. Lower from 880°C. to 780°C. in 36 min., again with sharp drop at end of fall. Rise immediately from 780°C. to 880°C. in 2 min. Total time 2 hours. (Summary: three 40-min. periods.)

Referring to the *Cycle Controller cam:—*

Cam follower will climb up the first slope and stop when C1 is operated. When No. 1 Unitact Pyromaster closes the circuit, the cam will rotate and as the cam follower climbs the second slope, C2 will be closed; C2 remains closed until the cam follower drops down to the lowest position again. The time during which C2 is closed requires to be varied between 2 min. & 4 min. and to be sent out with the segments set at 3 min. When the cam follower has dropped to the lowest point, both C1 and C2 are operated, so stopping the Cycle Controller cam.

Referring to Sketch B, the sequence of operations will be as follows:—

Starting from the positions where the cam follower on the Program Controller is on the 880°C. point and the temperature in Pot No. 1 (Sketch E) is below 650°C., which is the control point of No. 1 Unitact Pyromaster:—

(1) The temperature in the furnace muffle will be controlled at 880°C. until the temperature in Pot No. 1 reaches 650°C. When this point is reached, No. 1 Unitact Pyromaster makes high contact, which gives a circuit through switch *B.P.* and the program control cam motor field *P*, rotating the cam, also a circuit through the Cycle Controller.

(2) Shortly after the cycle controller has commenced rotating, the cam follower climbs up the first slope, moving C1 to the down position, thus breaking the cam motor field and stopping the cam rotating.

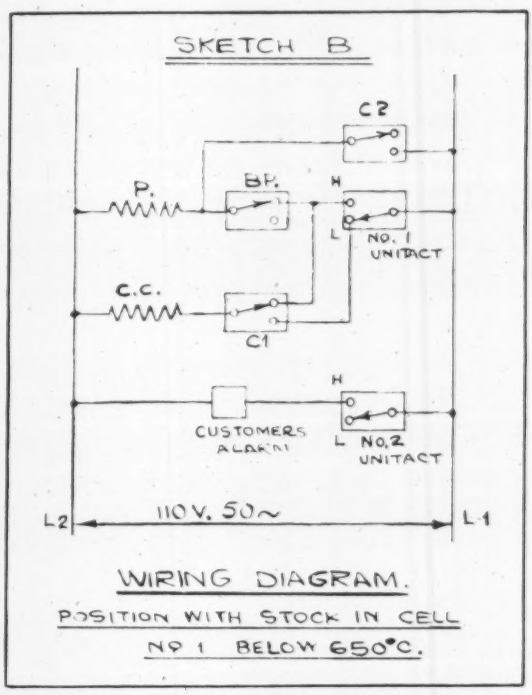
(3) Motor *P*, however, continues to rotate until the cam follower reaches the 780°C. point where the cam follower arm opens switch *B.P.*, thus stopping the cam motor *P*.

(4) The muffle temperature then continues to be controlled at 780°C. until Pot No. 1 reaches the annealing temperature. No. 1 Thermocouple is then withdrawn and the pot taken out and a fresh cold pot put in. The resultant cooling of No. 1 thermocouple causes No. 1 Unitact Pyromaster to make low contact. As C1 is in the down position, this gives a circuit through the Cycle Controller motor, causing the cam to rotate.

(5) As the cam rotates, the cam follower climbs up the second slope, closing C2. This completes the circuit through the motor field *P* rotating the program control cam, causing the cam follower to rise up the cam from 780°C. to 880°C. in 2 min. and travel along the "hold" portion at 880°C. for 2 min.

(6) At the end of 3 min. the Cycle Controller cam follower drops down to the lowest point on the cam, breaking C2, thus stopping motor *P* and moving C1 to the up position, stopping C.C. motor.

(7) The cycle is then repeated, starting from the point where the muffle is controlled at 880°C.



P.—Cam Motor of Program Controller.

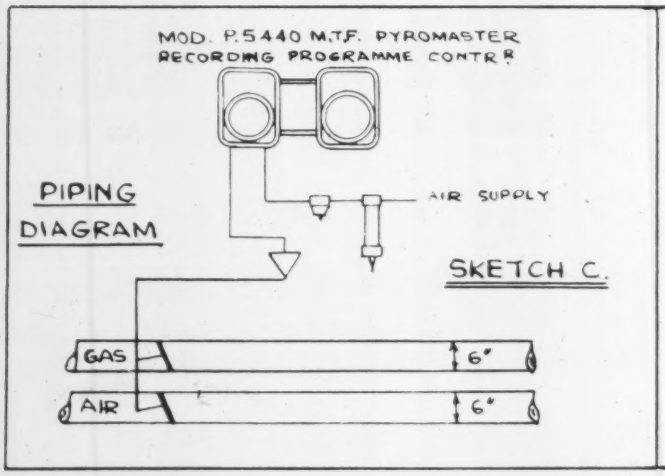
C.C.—Cam Motor of Cycle Controller.

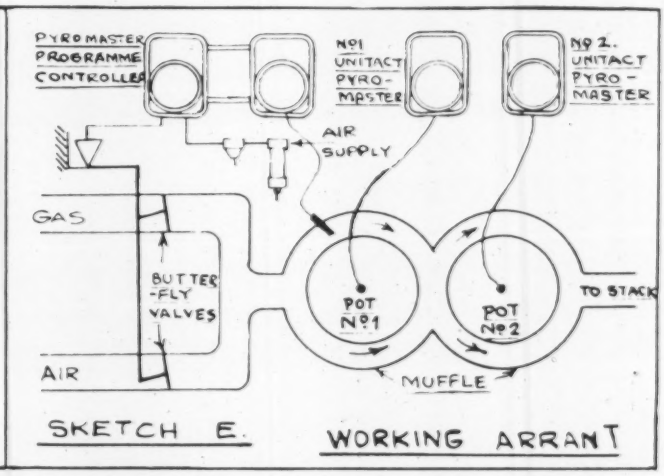
BP.—Micro Switch operated by cam follower of Program Controller.

C1—No. 1 Double-throw Micro Switch on Cycle Controller.

C2—No. 2 Single-throw Micro Switch on Cycle Controller.

*Copied from a blueprint accompanying Mr. Dupen's typewritten manuscript. This blueprint, though undated, is obviously older than the manuscript written for the Contest. Moreover, it would seem that some modifications were made, such as cutting new cams, etc. Therefore, although we print this "Legend of Operations," we do not publish the sketches of the original cams.—EDITOR.





put to the preheating cell inconsistent, reducing the efficiency of preheating, imposing unnecessary temperature stresses on the refractories and thereby limiting output.

It was thought that with a proportional type controller, having a modulating valve operation, the flame length would be reasonably constant and a better output could be obtained. Further, by making the furnace instrumentation completely automatic, unnecessary manual adjustments by operators could be eliminated.

A coördinated control system was designed by Bristol's Instrument Co. Ltd., London, and consisted of a Bristol's Pyromaster Pneumatic Program Controller, two Unitact Pyromaster Controllers and a Process Cycle Controller. These instruments worked in coördination with one another, the Pyromaster Program Controller to control the muffle temperature, the two Unitact Controllers as limiting controllers, recording charge temperatures and the Cycle Controller as a resetting instrument.

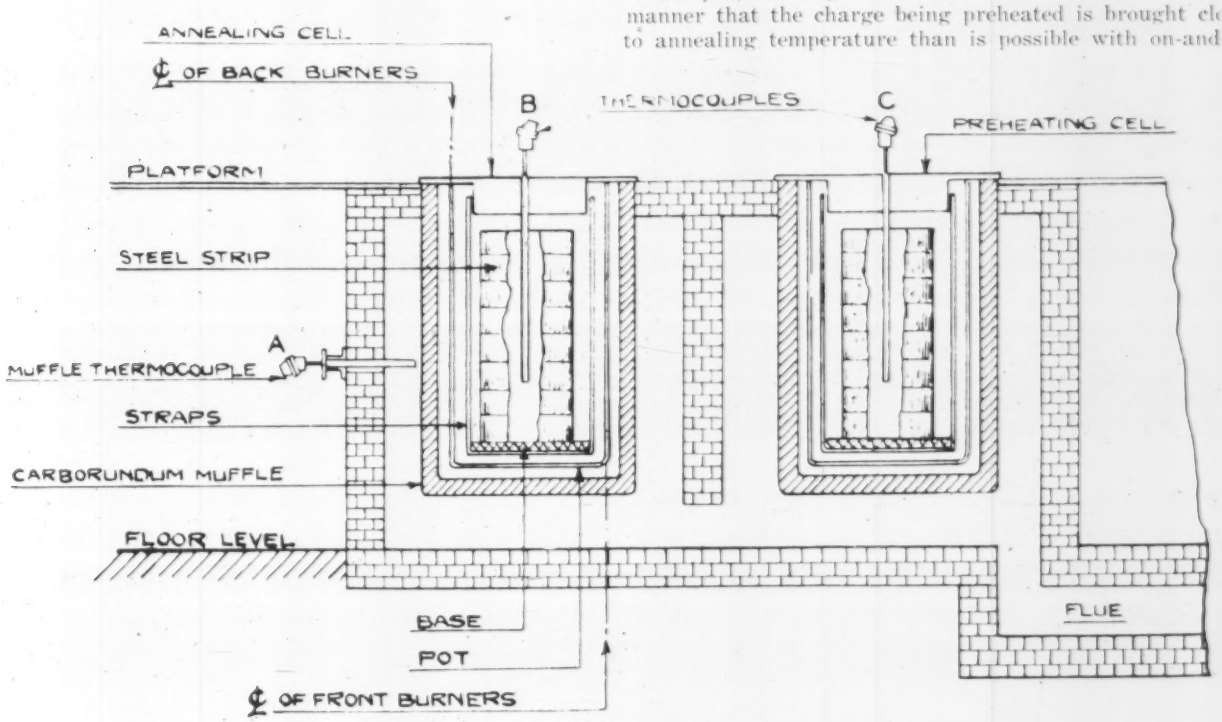
Referring to the drawings, it will be noted that the Pyromaster Program Controller controls the muffle temperature by modulating gas and air butterfly valves connected by suitable linkage to a pneumatic lever motor. This instrument controls the muffle temperature at about 860°C. until such time as the charge in No. 1 cell reaches a temperature of about 600°C. when high contact is made in No. 1 Unitact Controller, which sets in rotation the cam of the Pyromaster Program Controller.

The rotation of this cam progressively lowers the muffle temperature over a period of one hour to about 780°C. thus reducing the differential between the muffle and load temperatures, preventing the straps supporting the load from overheating, but still maintaining a higher heat input to the furnace than would be possible if the muffle temperature were lowered in steps.

When the Pyromaster Program Controller cam reaches 780°C., the cam stops and the muffle temperature is controlled at this point until the charge in No. 1 cell reaches annealing temperature when it is withdrawn and thermocouple *B* removed. The cooling of this couple causes No. 1 Unitact Controller to make a low contact, bringing into circuit the Cycle Controller which resets the cam of the Program Controller and raises the muffle control point to 860°C., ready for heating the preheated load in No. 2 cell, which is now placed in No. 1 cell, a fresh preheating charge being placed in No. 2 cell.

The object of No. 2 Unitact in the preheating cell is solely to safeguard the load; it has no control function but sounds an alarm if a light load in No. 2 cell reaches annealing temperature before a heavy load in No. 1 cell.

With a fully automatic control of this nature, it can be seen that the operator has no cause to interfere with the instruments; they function and reset themselves automatically, maintaining a consistently long flame with a high heat input, utilizing waste heat to the maximum in such a manner that the charge being preheated is brought closer to annealing temperature than is possible with on-and-off control methods. Additionally, by reducing the muffle temperature on a time-temperature basis, a high heat input is maintained to both charges without the possibility of endangering the load supporting straps or nonuniform heating of the steel.



DIAGRAMATIC ARRANGEMENT OF GRUNEWALD FURNACE.

The combination of a long and steady flame with minimum reduction of heat input when annealing temperature is being approached, together with a quick and automatic get-away when the charges are transferred, has resulted in a great increase in output, as shown by results in Table I which, in itself, is sufficient evidence of production speed up.

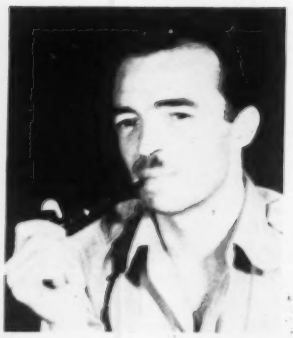
TABLE I.

After the six sets of Pyromaster Controls had been in use about eight months, definite advantages were credited to the instruments. Due mainly to the proportional type control, combustion atmosphere and flame length was kept consistent, so that a far greater heat input to the preheating cell was obtained, together with maximum heat input to the annealing cell. This resulted in the following production output increase on identical furnaces, but with the old on/off control and proportional control compared. The figures given are output per week taken at random between May and September 1940.

	Week A		*Week B*		*Week C*	
	Tons	*Cwts*	*Tons*	*Cwts*	*Tons*	*Cwts*
On/off control.	61	11	54	1	59	11
Proportional control.	112	19	91	3	113	17
Increase.	83.2%		68.6%		90.7%	

AVERAGE: 81.5% increased output.

"Born in 1907 and, like many other kids in 1917-18, fooled around with radios of the crystal-detector loose-coupler type. By 1922 I had completed three years of mechanical drawing with good marks, flunking practically everything else in high-school—which I left for radio servicing. Went to Florida during the boom, worked on a surveying gang, in lunch wagons, piloted a plane, served as a life guard, etc. Back to New Jersey in 1925, drove a taxi, then worked for a radio set manufacturer. Went to sea; made three trips to South America, and one to California, where I worked in a store while studying for the Army Air Corps exams. Flunked. Hitchhiked back to the East; went to sea again: England, France, Bermuda and Venezuela—this last on a sailing ship. Then, in turn, seaman on a yacht, skipper of a 60-foot express cruiser, radio serviceman, toolmaker at ChrisCraft and then at Chrysler in Detroit.



"In 1929 I came East again and did some experimenting in my small basement shop where I repaired radio set and tube testers. Went to sea again, first as skipper of a small boat, then as seaman on the Grace Line to Venezuela. Left ship to take charge of small-tool equipment for a platinum and gold mine in the Columbian jungle, where malaria laid me low. Recovering, I worked my way back to the States. Did sound effects for the NCB, then machine maintenance for a radio-tube manufacturer, then to SKF as toolmaker working principally on dial indicators.

"From 1935 until late in 1940 Chief Engineer for the Federal Products Corp. where I did research on precision measuring instruments. Now with Sperry Gyroscope.

"Have contributed articles on measuring devices to *Product Engineering* and *The American Machinist*, and one on stroboscope circuits to *Electronics*."

The "Three-point Method" of Measuring Bores

Awarded the $100 Second Prize in the Third Annual Instrumentation Contest

By C. C. STREET

Chief Engineer, Federal Products Corp., Providence, R. I. (Now with the Sperry Corp., Long Island City, N. Y.)

WITH the increased precision of modern boring and honing machinery, there has arisen a need for accurate means of measurement. Devices and methods by the score have appeared on the market and almost all of these incorporate, as the basic principle, either one of two measuring principles. These are namely the "true diameter" and "three point" methods. The "true diameter" method gives an indication of the diameter accurately if certain aligning devices are incorporated in the gage. Fig. 1 shows this method schematically.

The fixed point B is called such because during any one group of measurements it remains fixed with respect to the frame of the gage. Centralizing points D and C are constrained to move rectilinearly and parallel to the plane produced by points A and B. This forms an isosceles triangle with points B, C and D at the vertices. If the gage

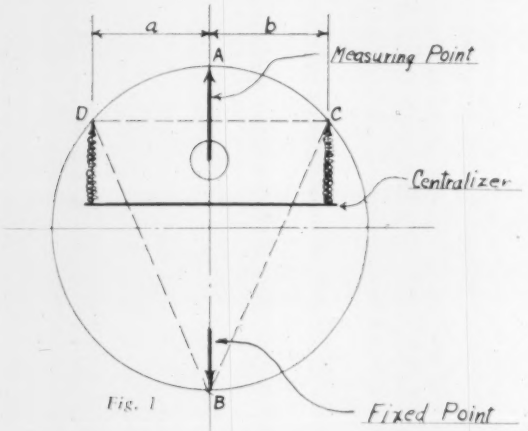


Fig. 1

is made with $a = b$ then the plane of AB will be on the diameter of the bore. The measuring point A can now make an accurate comparison of the bore being inspected. One of the problems of the design is that points C and D must exert a moderately high force so as to properly centralize the gage and the reaction of this force must be carried by point B. When a soft and highly polished material is being measured, point B is liable to seriously mark the bore. It also is at times difficult to design all of this equipment into the space allowed by small diameters.

Much of this can be overcome by using the "three-point" method. This principle is that of determining the change in the altitude of an isosceles triangle that can be contained in the bore under inspection. This is shown in Fig. 2.

Points B and C are usually made so that they can be adjusted to alter the nominal size of the gage within certain limits but remain fixed with respect to the gage body during the checking of any one bore size. The triangle formed by points A, B, and C is self-locating and requires no accessory equipment. The height of the triangle h will not change in direct proportion to the diameter but this difficulty may be overcome by proper design.

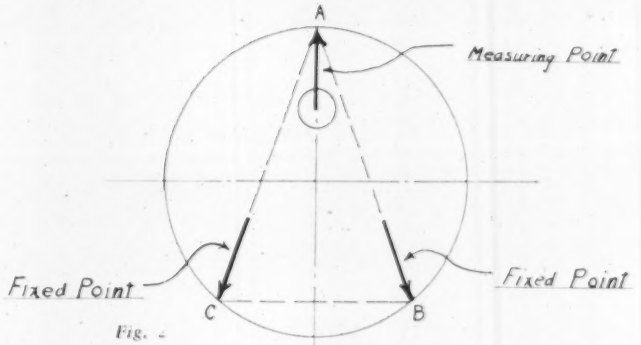


Fig. 2

Fig. 3

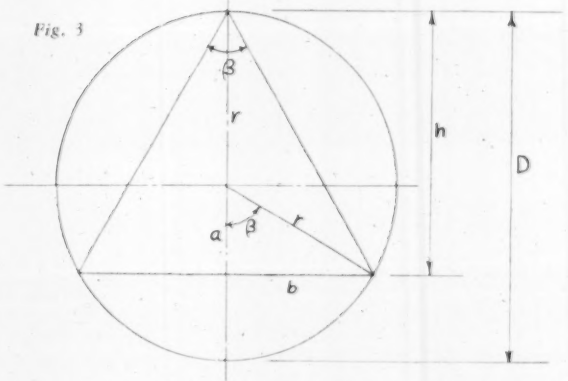


Fig. 3 shows the geometric design of the fixed and measuring points. The following discussion shows the manner in which such a gage can give the true difference in diameter between the master setting ring and the bore under inspection.

Let

$$h = r + a = r + \sqrt{r^2 - b^2} \qquad r = \frac{D}{2}$$

Sub for r,

$$h = \frac{D}{2} + \sqrt{\frac{D^2}{4} - b^2} \quad . \quad . \quad . \quad \text{(Eq. 1)}$$

Differentiating with respect to D

$$\frac{dh}{dD} = \frac{1}{2} + \frac{D}{2\sqrt{D^2 - 4b^2}} \quad \ldots \quad \text{(Eq. 2)}$$

From Figure 1.

$$b = \frac{D \sin \beta}{2} \qquad b^2 = \frac{(D \sin \beta)^2}{4} \qquad 4b^2 = D^2 \sin^2 \beta$$

$$\frac{dh}{dD} = \frac{1}{2} + \frac{D}{2\sqrt{D^2 - D^2 \sin^2 \beta}} = \frac{1}{2} + \frac{1}{2\sqrt{1 - \sin^2 \beta}} = \frac{1}{2} + \frac{\sec \beta}{2}$$

$$\frac{dh}{dD} = \frac{1 + \sec \beta}{2} \quad \ldots \ldots \quad \text{(Eq. 3)}$$

Equation 3 is only applicable when b is considered to vary with D. This condition is true when the gage is set for the nominal size. After adjustment is made b becomes a constant and must be treated as such. From equation 2 it can be seen that dh/dD will now vary with changes in D. The rate of change of dh/dD may be determined by taking the second derivative of equation 1.

$$\frac{d^2h}{dD^2} = \frac{2\sqrt{D^2 - 4b^2} - 2D \dfrac{2D}{2\sqrt{D^2 - 4b^2}}}{4(D^2 - 4b^2)} = -\frac{2b^2}{(D^2 - 4b^2)^{1.5}}$$

Sub for b:—

$$\frac{d^2h}{dD^2} = -\frac{(D^2 \sin^2 \beta)/2}{(D^2 - D^2 \sin^2 \beta)^{1.5}} = -\frac{\sin^2 \beta}{2D(1 - \sin^2 \beta)^{1.5}}$$

$$\frac{d^2h}{dD^2} = -D^{-1} \frac{\sin^2 \beta}{2(1 - \sin^2 \beta)^{1.5}} \quad \ldots \quad \text{(Eq. 4)}$$

Over the range $\triangle D$, the range of the indicating device, d^2h/dD^2 may be considered as linear. The value of dh/dD for any point will be

$$\frac{dh}{dD} = \frac{1 + \sec \beta}{2} \pm \left[\left(-D^{-1} \frac{\sin^2 \beta}{2(1 - \sin^2 \beta)^{1.5}} \right) \triangle D \right] \quad \ldots \quad \text{(Eq. 5)}$$

For any given instrument the value of dh/dD determined by equation 3 will be the average. If we assume the mean value of D to be 3" and $\triangle D = 0.005$" with $\beta = 60°$ we have:

$$\frac{dh}{dD} = \frac{1 + \sec \beta}{2} = 1.5$$

and: $\qquad \triangle h = 1.5 \ \triangle D = 1.5 \times 0.005 = 0.0075"$

If we now take equation 1 and solve for h at the nominal size and also at $D + \triangle D$, the difference of these values will give us $| \triangle h |$.

$$h = \frac{D}{2} + \frac{1}{2} \sqrt{D^2 - 4b^2} = \frac{D + \sqrt{D^2 - 4b^2}}{2}$$

Here $4b^2$ is equal to $D^2 \sin^2 \beta$. If β is 60°, $\sin^2 \beta$ is 0.75 and: $\qquad 4b^2 = D^2 \sin^2 \beta = 9 \times 0.75 = 6.75$

Then: $\quad h = 1.5 + \frac{1}{2} \sqrt{9 - 6.75} = 1.5 + \dfrac{1.5}{2} = 2.25$

Now adding $\triangle D$:—

$$h + \triangle h = \frac{D + \triangle D + \sqrt{(D + \triangle D)^2 - 4b^2}}{2}$$

Let $\triangle D = 0.005$

$$h + \triangle h = \frac{3.005 + \sqrt{(3.005)^2 - 6.75}}{2} = \frac{3.005 + 1.50998}{2}$$

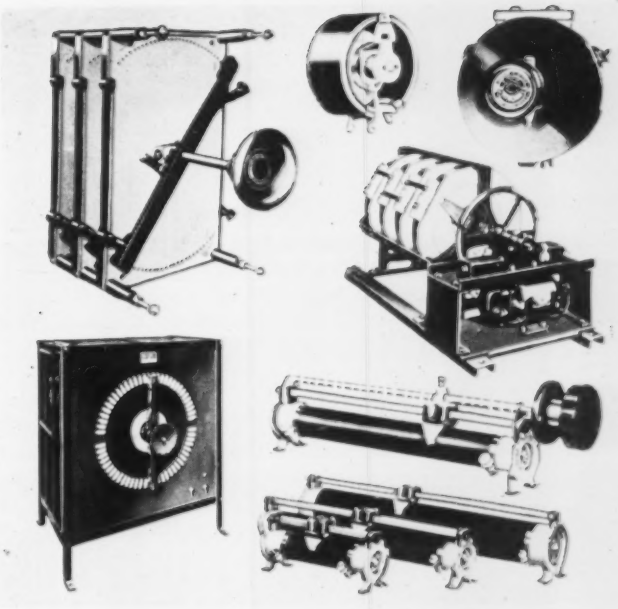
$$= 2.25749$$

$$\triangle h = 2.25749 - 2.25 = 0.00749$$

The error introduced by using the constant-ratio method is

$$0.0075 - 0.00749 = 0.00001"$$

From this it can be seen that if the dial of the bore gage is so graduated that it reads 0.005" when the contact has actually moved 0.0075" it will indicate the change in the diameter with an accuracy of 0.00001". Such precision is well within the tolerances of Defense production jobs.



A RHEOSTAT LINE THAT IS COMPLETE

The bulletins describing the various Ward Leonard Rheostats are probably the most complete compilation of Rheostat data ever assembled by a single manufacturer. They cover a range from the tiny types for fractional horsepower motors to the mighty multiple units that control the rolling of steel. The subjects of manual and motor drives, mountings and accessories are likewise completely covered. Ward Leonard is a quality line. Each item represents the "latest" in the field. Make your selection from the Ward Leonard data bulletins and be assured of a successful installation.

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Rapid Production Test for Case Depth

Awarded the $50 Third Prize in the Third Annual Instrumentation Contest.

By FRANK DEDEK

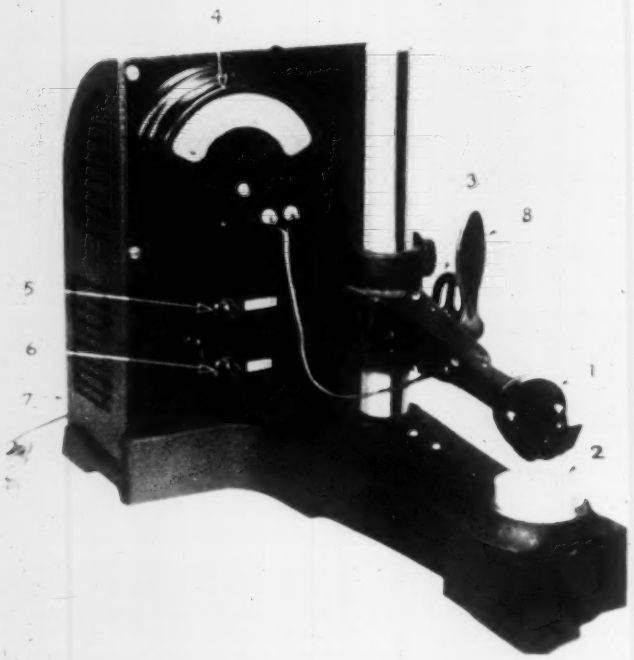
Consulting Metallurgist, Magnetic Products Corp., Detroit, Mich.

RECOGNIZING that industry lacks a production test for rapidly measuring and checking carburized case depths, and surface conditions of manufactured parts, the "Penetor," a magnetic tester, has been produced for this purpose.

DESCRIPTION

Test Unit 1 is designed to accommodate pieces of any shape. Flat, round or tapered parts are tested with equal accuracy because of the self-aligning features of this unit.

Interchangeable Anvils 2 permit the design of special nests and fixtures, while Pinion Gear Lift 3 is for height adjustment.



The linear Instrument Scale 4 is divided into one hundred divisions, spaced 1/16" apart to insure visibility to the operator. Readings are direct, and a pointer-limiting device has been provided to accelerate readings.

Knobs 5 and 6 are for standardizing surface and depth readings.

Oscillator Unit 7 to be operated on 115 volts, 60 cycles.

METHOD OF TESTING

Quotation from Hoyt's *Metallography* (1921) page 235:

That there is a definite relationship between mechanical and thermal treatment of steel and its magnetic characteristic has been shown by Robin, who gives rules and tables of data according to which the composition, thermal and mechanical treatments of any article of regular shape of steel or nickel alloy can be determined from the characteristic shapes of magnetic curves. The Bureau of Standards has also done considerable and very valuable work in this field. This work is so important and of such a nature that the originals should be consulted for the details.

A great deal of work has been done to correlate the grain structure and mechanical properties of ferrous alloys with resultant magnetic characteristics, but no simple device has ever been offered to put this method into practical use.

The Penetor fulfills the task of testing parts instantaneously without the need of consulting charts or tables, and in addition, it has the ability to measure the depth of case. Earlier forms of testing with high-frequency currents made use of an a-c. bridge, in which the impedance of a coil surrounding the test specimen is balanced either against a standard specimen in a similar coil, or against a synthetic standard of equal impedance. The Penetor uses a basically different method. When a test piece is placed under the test unit and handle 8 is brought forward to a stop, alternating flux will flow in the test piece. This flux will be dependent upon the reluctance of the magnetic path of which the test piece is now an integral part. The resultant variation in reluctance is measured by a variation of current in the instrument and interpreted in terms of hardness. Two fixed high frequencies have been selected to cover surface and depth readings. An added feature of this device is the "spot test," meaning that readings are only taken in a small area, and at a predetermined controlled depth. The prior attempts merely gave a reading of the average condition of an entire test piece and could not locate local defects of any given or limited area of the material tested.

Frank Dedek was born thirty-seven years ago in Stuttgart, and is a graduate of the Polytechnic Institute of that City. He studied Metallography at the Detroit City College. For the past seventeen years he has been associated with several industrial plants in Detroit, doing experimental research work. He also serves as a consulting metallurgist and makes a particular study of applications to magnetic steel testing.

Special preparation of pieces to be tested is unnecessary; no marring or deformation will take place, as the test unit need only touch lightly, and only for a moment, the surface of a part, to obtain a reading. However, a certain procedure has to be followed to successfully employ this new method. For production testing, the instrument is used as a comparator. Material of a certain alloy should be compared with a master sample of like composition and the necessary heat treatment.

For example, the 100% inspection of wrist pins, not only for depth of case, but also for skin hardness:

All that is needed for this test is to prepare one wrist pin to the desired specifications, establish a reading on the instrument scale for this particular part, set limiting device on scale to the tolerance that is permissible, and the operator may now proceed with the test by simply placing parts on the anvil, actuating the handle and observing the position of instrument pointer. As many as 1800 case depth measurements per hour may be accurately taken.

To further increase the operating speed, the Penetor may be equipped with a foot pedal or motor, as desired. For large work the test unit may be removed from its mounting and used as a hand tester. This has been found extremely useful for locating welding stresses and testing for hardness or defects at normally inaccessible places such as the inside of sleeves, dies or cylinder blocks.

THE PENETOR IN PRACTICE

The applications for which this device may be used are innumerable, but the following explanations and charts of the results of tests are a fair indication of the possibilities for this test instrument: *(Concluded on page 24)*

Taylor Is Helping America Hang Up a Sign

HAVE you seen the signs? Look anywhere. Look in that factory, out Seattle way. There's the sign—*This Load Ready to Move*—on that bin of finished bolts. Look in that big airplane plant. There's the same sign, on that sleek Army streamliner. Look in that oil refinery. See the sign, over there, on that string of flat cars? It's on that mountain of clothing, too—it's on that pile of canned foods.

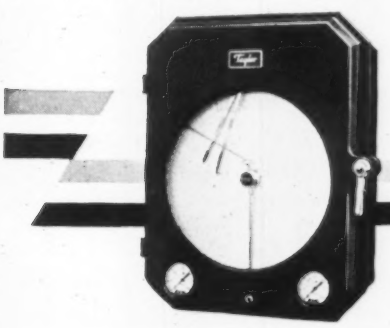
American Industry is producing at top speed today. Producing the goods that this nation needs. Producing faster, much faster. In a steady, reassuring, growing stream, vitally necessary products are rushing out of plants and factories. America is going to be ready, just in case . . .

Preparing to protect ourselves and our ways is a huge job that can't be done slipshod. We've got to work well, and we've got to work fast. We *are* working fast. We can do it, because we're lucky.

No other Industry in the world is equally equipped to produce quality in high gear. No other Industry has better, more modern machines. No other Industry has finer instruments to *help* these machines produce.

Times like these make instruments like the great new Taylor Fulscope Controller an absolute industrial "must." Today all plant operations *must* be automatically more exact, automatically more foolproof, automatically faster, more efficient. Machines must think for themselves more clearly. The Taylor Fulscope helps them to do that.

Taylor Instruments have never had a bigger opportunity to "show their stuff." Fact is, these are Taylor times. Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada.



The New Taylor Fulscope Controller
The "Not 1, but 5" Instrument

BE PREPARED WITH **Taylor**

Indicating Recording · Controlling

TEMPERATURE, PRESSURE, FLOW
and **LEVEL INSTRUMENTS**

Tungsten Production from American Ores Increased by Instrumentation

Awarded a Fourth Prize in the Third Annual Instrumentation Contest.

By WILLIAM H. SAYLER
Manager, Specialty Sales Co., Salt Lake City, Utah

ONE of the strategic metals in our defense program is tungsten. This article will briefly describe one of the principal control problems involved in making available several million pounds of tungsten that would not otherwise be available. The Nevada Massachusetts Company at Mill City, Nevada, has been operating since 1918 on a metallurgical process that left a fraction of one per cent of tungsten in the tailings, of which there are now several million tons. With the rise of the present emergency the management decided to coöperate to the fullest extent with the defense program by installing a complete plant to recover the small percentage of tungsten still in these tailings.

A small pilot plant was built to determine the best method of handling this material. The process finally used consists essentially of a classifying and grinding operation to prepare the material for flotation, using selective flotation for making the final separation. A scalping flotation is used first, to remove metallic sulphides, principally iron and copper, from the ore pulp. After this operation the ore is further conditioned so that the tungsten ore, which is present as scheelite, may be floated, and recovered.

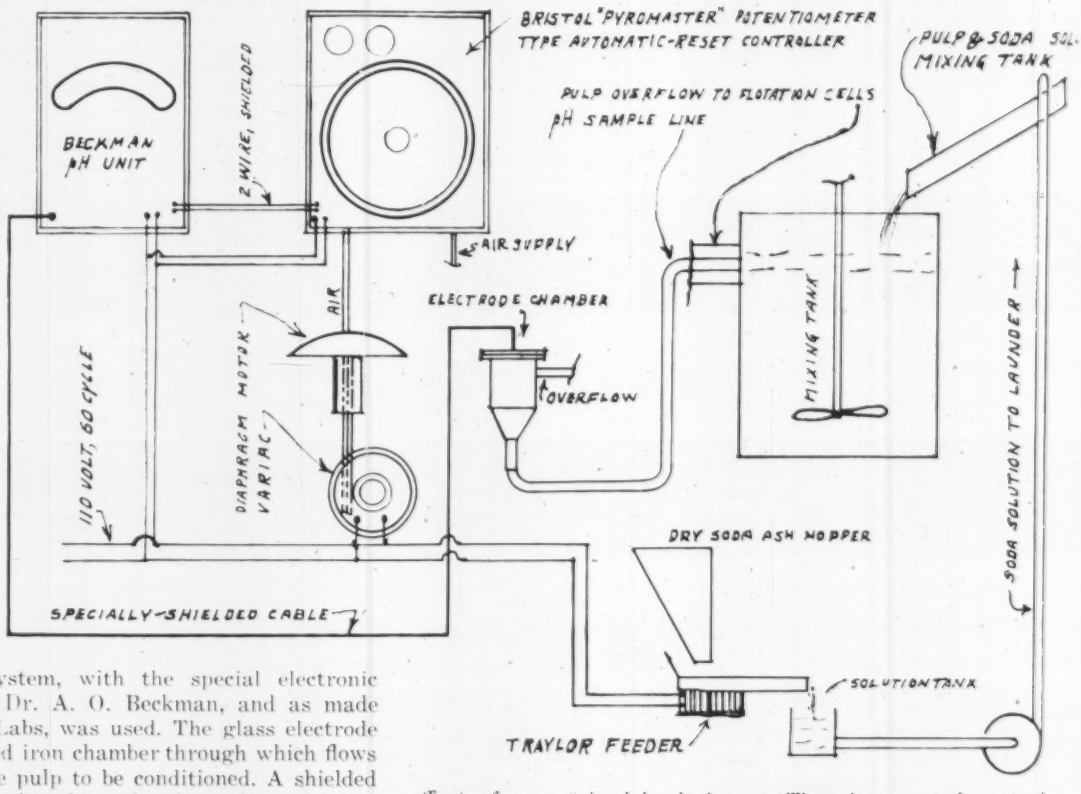
Mr. George Crerar, metallurgist for this company, found that it would be possible to operate this process economically and make it financially attractive, only if close control of pH value in conditioning for the flotation process could be obtained. Through one of our company's connections, the problem of control was referred to me.

A study of the process was made and a system of control was recommended. The mining company accepted the recommendation and installed the system. For measuring the pH value, the Beckman glass electrode system, with the special electronic amplifier developed by Dr. A. O. Beckman, and as made by National Technical Labs, was used. The glass electrode is mounted in an enameled iron chamber through which flows a constant sample of the pulp to be conditioned. A shielded cable runs about seventy feet from the electrode to the amplifier, which is mounted on a panel board at a convenient point. Also, on this panel board is mounted a Bristol Pyromaster air-operated reset type automatic controller, with a chart range of 6-13 pH. Its controlled air line goes directly to a diaphragm motor, which, through a rack and pinion, operates a General Radio Company Variac. This Variac impresses a continuously-variable voltage on a Traylor Vibrator type feeder, which in turn feeds the amount of soda ash required to maintain the pH value at the proper point.

The reset type controller was chosen for the process, as there are several variables in the process which have the effect of a sustained load change. The air-operated control system was chosen, even though the final control is electrical, to obtain adjustable throttling range and adjustable rate of reset. Also the air controller is rugged, trouble-free, and immune to vibration. With extreme load changes, the pH of the pulp does not change over one-tenth of a point, and then only for five minutes.

So far as the writer is aware, this is the first installation in the United States, of this type of control on the flotation process. It is of peculiar interest, in that it is an instance of the application of coördinated control in making feasible the recovery of several million pounds of a valuable strategic metal that would not otherwise be available.

"Born in Indiana, grew up in South Dakota, graduated from High School at Mitchell, S. D., 1917. Four years as a range rider, then two years at South Dakota School of Mines where a professor of English taught me that the English language is just as important as mathematics to an engineer. Left school to go to work for J. C. Buckbee Co., Chicago, first as a cub, later as field engineer, principally on cement mill construction. After four years with this firm, I spent my savings poking around the Black Hills mining district, then spent a few months on survey work with a consulting geologist. Employers following were Denver & Rio Grande RR. Co., Utah Copper Co., Counterflo Heater Co. (since defunct), a contractor (financially defunct now). Then came the depression. I couldn't find a job, so with the savings of a friend, who is now my partner in business, we started the Specialty Sales Co. That was in 1931. The first years were lean, but we hung on, and here we are. . . ."



Use of a Standard Rectifier Type A-c. Microammeter as Averaging Device

Awarded a Fourth Prize in the Third Annual Instrumentation Contest.

By WAYNE T. SPROULL
General Motors Research Laboratories, Detroit, Mich.

A COMMON problem encountered in many branches of instrumentation, and especially in electrical measurements, is the problem of accurately measuring the average value of a magnitude which varies irregularly and rapidly over a wide range. As an impractical but instructive example, suppose that you were asked to weigh a person who is performing a violent and erratic tap dance upon the platform of a platform scale, so that the pointer is furiously whipping around every mark on the dial. If you used a high-speed motion picture camera to obtain several hundred individual readings, you could determine the dancer's weight with considerable accuracy by averaging all of these readings, but is there not some easy, cheap, and practical way to do this?

The advent of the electrolytic condenser and the copper oxide rectifier in recent years has indeed given us a method which offers an easy, cheap and practical solution for the above problem.

Today you can buy for a few dollars a condenser having a capacity of 5000 microfarads. It weighs only about a pound and it will slip into your coat pocket. Such a thing was unthinkable just a few years ago.

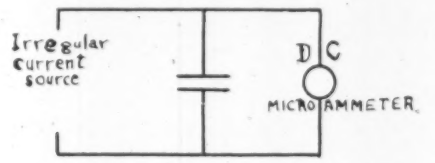


Fig. 1

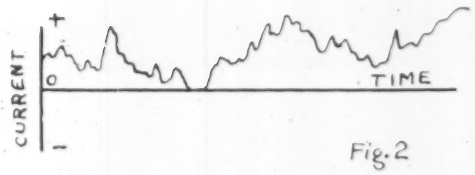


Fig. 2

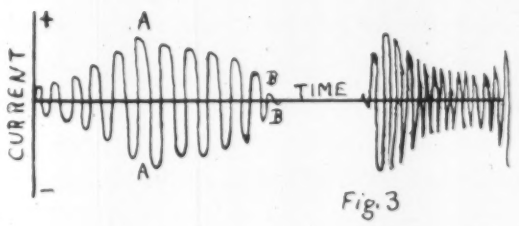


Fig. 3

One of these condensers shunted around a d-c. microammeter as shown in Fig. 1 will cause the instrument to indicate the average value of a unidirectional current varying irregularly as shown in Fig. 2. The condenser will charge up until its voltage is sufficient to cause a steady discharging current through the instrument just intense enough to balance the average input of the irregular charging current being measured.

A more difficult problem, however, is to determine the average value of an irregularly varying alternating current such as that shown in Fig. 3, which shows the type of current we might expect from the output stage of an audio-frequency amplifier. An a-c. instrument indicating this current would jump rapidly between high readings such as at instant *AA* and low readings such as at instant *BB*. Shunting such an instrument with a high-capacity condenser as in Fig. 1, however, would merely cause it to register zero,

Wayne T. Sproull was born in Wisconsin in 1906, and his parents immediately moved to Pittsburgh where he attended common school. In 1918 he moved to Akron, Ohio, where he attended high school and later the University of Akron (B.S. in physics, 1927). Then to Lehigh University (M.S. in physics, 1929), then to the University of Wisconsin (Ph.D. in physics, 1933). Since early 1933, physicist in the G M Research Labs. The device here described, however, was evolved in the course of some consulting work unrelated to GM.

which is the average value of the current considered as direct.

The advent of the copper oxide rectifier has enabled the electrical instrument manufacturers to put on the market the so-called rectifier type a-c. microammeters. Although sensitive (100 microamperes full scale), these instruments are small and portable, being about three or four inches in diameter and less than two inches thick, and the cost is around $20. These instruments contain a small full-wave copper oxide rectifier, *RR*, Fig. 4, and a regular d-c. microammeter *A*. Alternating current entering at the binding

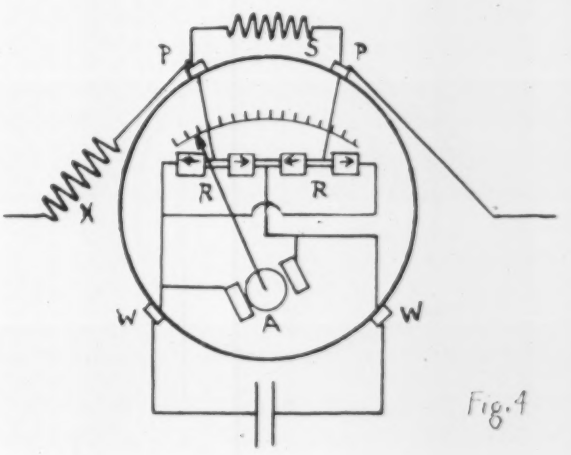


Fig. 4

posts *PP'* first goes to the rectifier where it is changed into pulsating d.c. which is then measured by the d-c. instrument.

It is a simple matter to open the case of one of these instruments and solder two extra lead wires, *WW*, to the wires running from the rectifier to the instrument proper. If these extra lead wires are now connected to a high-capacitance (1000 to 5000 μfd.) electrolytic capacitor, the instrument will read the average a.c. when the regular binding posts *PP'* are connected to an irregularly varying alternating current.

Such an instrument as this will measure the average value of any sort of current, either alternating or direct, whether steady or fluctuating in any manner whatsoever.

If the current to be measured is too large for a microammeter, the instrument can of course be provided with a shunt *S* having appropriate resistance. Or, if it is desired to measure a varying voltage rather than a varying current, a series resistance *X* of the proper value will convert the instrument into an averaging a-c. voltmeter.

Since almost any physical magnitude, such as force, distance, temperature, pressure, light intensity, sound intensity,

etc., can be converted into a corresponding current or voltage, the device shown in Fig. 4 can be used to measure the average value of practically anything which fluctuates too rapidly to follow with an ordinary instrument and too slowly to average with an ordinary instrument.

One simple obvious application of this device is in the measurement of the sound level in a room where perhaps an orchestra is playing. An ordinary sound level meter will indicate rapid irregular variations of the sound intensity as each note is played, but the use of this averaging meter results in a steady average reading. During a crescendo passage, the pointer will move slowly upward along the scale as the average sound intensity increases; and as the music gradually subsides from fortissimo, the needle will move slowly down again, accurately showing the general trend of the intensity without all of the confusing erratic detailed fluctuations.

With a 5000-μfd capacitor, the average obtained covers a longer period of time than with a 1000-μfd capacitor. The more completely you wish to "iron out" minor irregularities the larger the capacitance you should use.

The necessity which led to the development of this averaging device arose during the development of an instrument for measuring the degree of discomfort suffered by passengers riding in automobiles or other vehicles due to jolts arising from rough roads or uneven track. Each individual jolt encountered during a ride of course gave a corresponding pulse in the meter reading, resulting in erratic indications. A steady reading was desired which would be an accurate measure of the average roughness. The device just described made it possible to obtain this accurate average. The riding comfort meter mentioned, known as the PRCA Riding Comfort Indicator, is now sold by the Commercial Engineering Laboratories, Detroit, Michigan.

Fluorescent Spotlight for Inspection

Awarded a Fourth Prize in the Third Annual Instrumentation Contest.

By WILLIAM TOBIAS

Junior Inspector of Ordnance, War Department

ONE does not have to look far today to see the important role that fluorescent lighting plays in facilitating defense work. With many plants operating on a twenty-four hour schedule, it is of utmost importance that a lighting condition approaching that of daylight be maintained at all times. This is especially true in regard to the inspection of material, since most efficient inspection can be carried out in daylight. The daylight Mazda F lamp has a color temperature of 6500° Kelvin which is a close match for average daylight.

There are a number of conditions encountered in inspection work where an ordinary incandescent bulb is unsatisfactory. If paint is to be applied to the interior of a metal tube it is important that rigid inspection be given after shot-blasting to ensure that there are no pits, cracks, laps, or seams that a coat of paint would obscure. It is also necessary in many cases to obtain complete paint coverage on the inside of pipe. In bomb manufacture, for instance, it is highly important that the inside of the bomb receive a thorough coating of an anti-acid paint. It is difficult to find "bald" spots on the inside of a painted tube with only the aid of an incandescent bulb because of the glare set up.

The device that I propose for the inspection of metal cylinders is a daylight fluorescent lamp enclosed in a cylinder of transparent Lucite so that it can be used as a searchlight. Due to the tubular shape of the bulb an even distribution of light could be obtained which would eliminate glare and provide a close approach to daylight inspection conditions. Since a fluorescent lamp produces one-half of the total heat and one-fourth of the radiant heat of a comparable incandescent bulb, it would be easy to handle. The closely-fitting Lucite cover would protect the bulb and at the same time provide more heat insulation. The small ballast device, which makes possible the use of alternating current at 120 volts, and the starting switch, could be incorporated in a handle. The unit would then be ready for use by merely plugging in to the nearest electric outlet.

Born in Pittsburgh 22 years ago. "Pop" Dysart's famous Physics classes in Schenley High directed him toward matters scientific. After graduating he helped dig Pittsburgh out of the 1936 flood mud. Won a scholarship to Carnegie Tech which he held for four years; graduated with a B.S. in M.E., June 1940. It was while working on the night shift at the National Tube Co. as an ordnance inspector that he conceived the idea of the fluorescent flashlight. He has just been promoted to Junior Engineer with the War Department.

Safety Inspection of Trains *en Route*

Awarded a Fourth Prize in the Third Annual Instrumentation Contest.

By A. E. F. BILLSTEIN

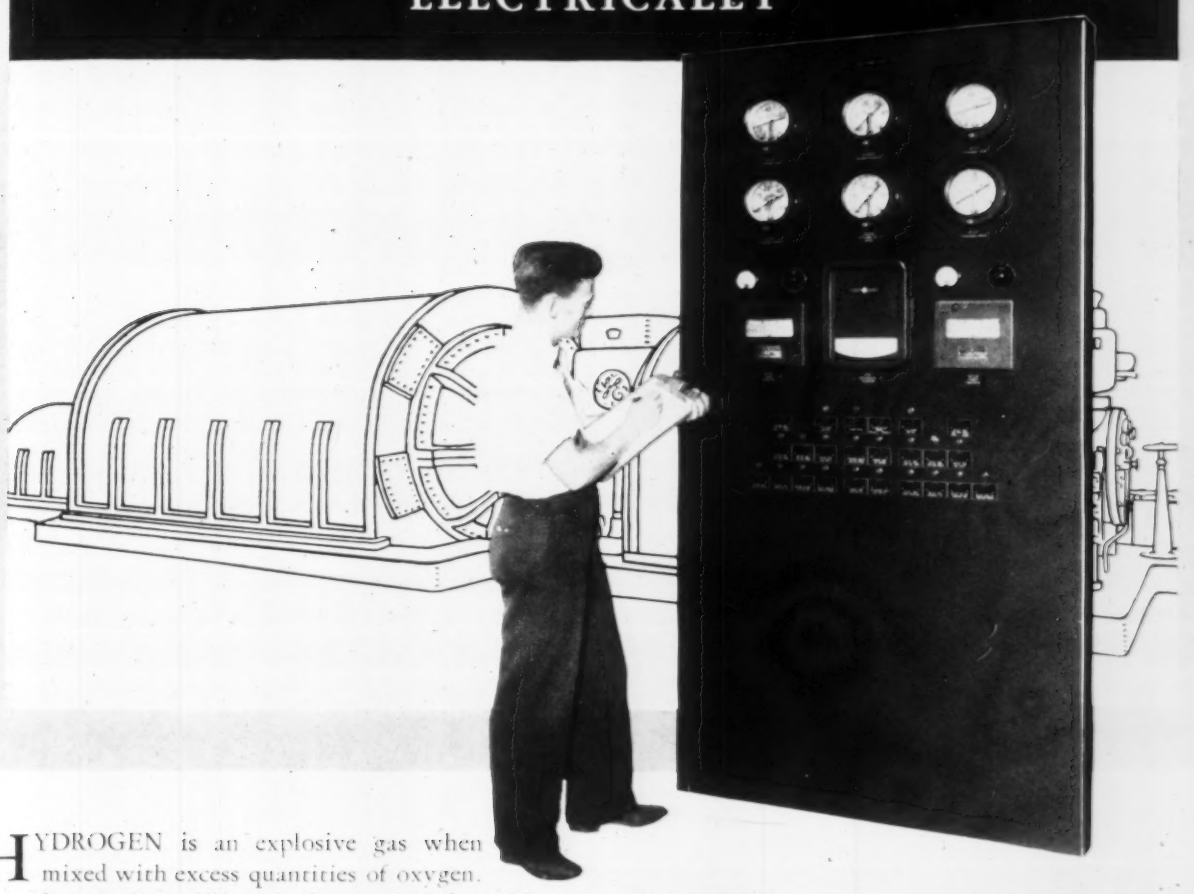
Assistant Engineer, Pennsylvania Railroad, Altoona, Pa.

NATIONAL Defense depends largely upon safe and speedy transportation. Machine tools, engines for our air forces, armor for our Navy, guns for the Army and thousands of other items must not only be produced but quickly transported. In the production of these items from components, likewise, transportation holds an important place. Fortunately for our country, the railroads are now operating more efficiently and at higher speed than those of any other nation. To maintain the present degree of safe transportation, systematic inspection is constantly

[To be concluded in an early issue . . . we hope! It depends upon the Pennsylvania Railroad AGAIN granting the permission which it had originally granted and which it withdrew, we were informed, when this issue was about to go to press.—EDITOR.]

Arthur E. F. Billstein, born in Chester, Pa., in 1895. World War service in France as Master Engineer in the 28th Engineers. Completed college education after returning from France. B.S. in E.E., and E.E., University of Pennsylvania. Entered special apprenticeship course in signal department of Pennsylvania Railroad. At present employed at the PRR Testing Laboratory. Married, two children and superintendent of the Methodist Church School. Taught Electrical Engineering at the Penn State Extension School. Past President of Altoona Engineering Society.

To *Measure* HYDROGEN PURITY ELECTRICALLY



HYDROGEN is an explosive gas when mixed with excess quantities of oxygen. Therefore, when filling hydrogen-cooled turbine-generators, converters, and condensers, it is necessary to know the hydrogen concentration at all times.

To fill the casing, carbon dioxide is pumped in, and air is let out until the percentage of carbon dioxide in air is about 70 per cent. Hydrogen is then admitted until the percentage of hydrogen in carbon dioxide is about 97 per cent. A somewhat similar reverse procedure is used to empty the casing.

This operation requires a means of measuring the various gas mixtures in order to prevent the formation of an explosive mixture. The changing analysis of the gas must be known throughout the operation, and particularly at the changeover points, so that safety of the procedure is assured. This requires an indicating instrument, for chemical analysis is too slow, as well as too expensive.

An electric instrument, operating on the thermal-conductivity principle, was developed by G-E engineers for this purpose. In addition to giving a continuous analysis, it indicates the purity of the hydrogen after the casing is filled, and while the machine is in operation. By means of an alarm system, it gives both visible and audible warnings, should the hydrogen mixture drop below a predetermined percentage.

In addition to building instruments for special measurement problems, G.E. offers a complete line of standard instruments for the measurement of any electrical quantity—current, voltage, resistance, watts—in styles and ratings to fill every need. When you have a problem that involves measurement, let us help you solve it. General Electric Company, Schenectady, N. Y.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

Stroboscope Tests Dynamic Unbalance in a Large Water-wheel-driven Generator

Awarded a Fifth Prize in the Third Annual Instrumentation Contest.

By CLAYTON M. SHERER

Ass't Chief of Tests, Pennsylvania Water & Power Co., Holtwood, Pa.

Mr. Sherer sent in a brief biography which we print in full: "I was born on a farm at Manheim, Pa. Graduated from Manheim High School. Attended State Teachers' College and taught in public schools. Graduated from Gettysburg College in 1920. Worked one year for General Electric Lamp Works at Newark, N. J., on development and test of lamp machinery. Present connection with Pennsylvania Water and Power Co. dates from 1921."

AN Edgerton stroboscope has been successfully used in the study of dynamic unbalance in a 42,500-horsepower water-wheel-driven electric generator. The technique employed in this particular problem can be applied to the dynamic balancing of any piece of rotating machinery while running under normal operating conditions, provided that its rotative speed is within the physical limits of an ordinary dial indicator to follow the shaft oscillations. The machine which is the subject of this discussion is a large vertical alternator, running at a speed of 109.1 r.p.m. Total weight of the rotating parts is approximately 1,148,000 lbs. Two guide bearings are used, one being located just above the turbine runner, and the other at the generator. Distance between these two bearings is about thirty feet. Dynamic unbalance of the rotating mass was sufficient to produce, with full load on the generator, shaft oscillations of 0.013" at the generator bearing, and 0.026" at the turbine bearing. Before any remedial measures could be applied it was necessary to determine, first, whether the unbalance producing the oscillations was in the turbine or in the generator, and second, after this was done, to determine the position of the "high side" in the machine, that is, at what point in the rotor the excess weight producing the oscillations is located.

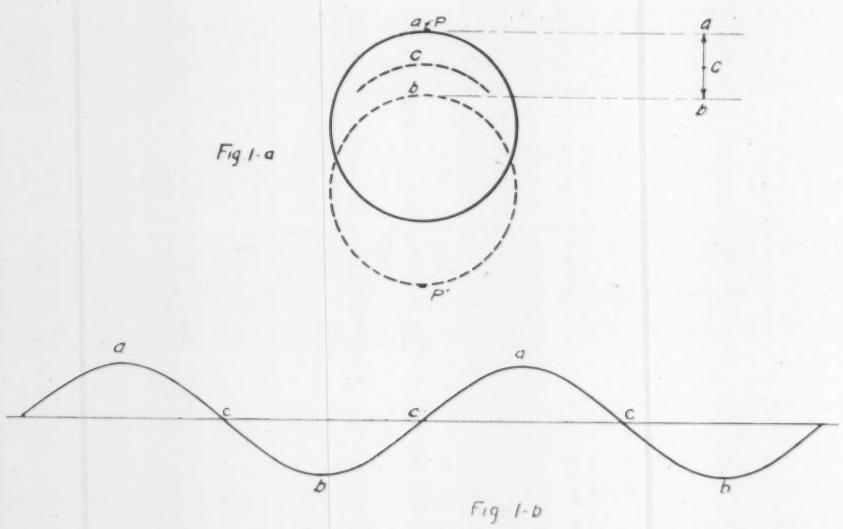


Fig 1-b

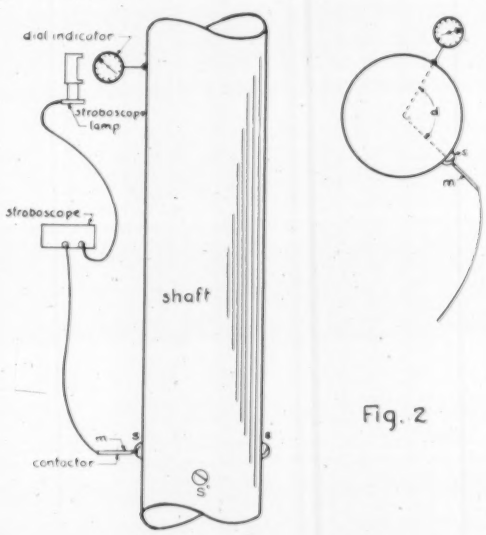


Fig. 2

The vibration of a shaft can be represented by plotting the motion of a point on the high side against time. In Fig. 1-b the sinusoidel displacement of such a point is shown plotted against time, or angular displacement of the shaft. The shaft oscillates back and forth from *a* to *b* as point *P* rotates on the shaft (Fig. 1-a). At a given instant the shaft will be in the position shown at *a*. After one-half revolution, or when *P* has moved to *P'*, the shaft will be in position *b*. At the quarter and three-quarter parts of a revolution, the shaft will be midway between *a* and *b*, or *c*. This movement of the shaft, shown in Fig. 1-a, is plotted against time in Fig. 1-b.

In studying vibration in this case, an ordinary dial test indicator was used to measure the amplitude of oscillation. An Edgerton stroboscope was used to find the location of the high side in the rotating mass. The crux of the whole balancing problem was in being able to locate this, for by that means it was easily possible to observe the effect of corrective weights added to reduce the unbalanced condition.

The diagram in Fig. 2 illustrates the method of test. Two brass machine bolts, *s*, were screwed into the shaft 180° apart and at the same elevation. These served as contacts for flashing the stroboscope lamp. The pointer of the dial indicator, placed as shown, moves back and forth as the shaft oscillates between *a* and *b* (Fig. 1). By going around the shaft with the movable contactor, *m*, the instant of lamp flash is advanced or retarded until it occurs at *c*, that is, at the oscillation mid-point. At this point the indicator pointer appears to be standing still at 0 on the dial, being illuminated twice per revolution of the shaft. The movable contactor is then dropped vertically downward about one-half inch to make contact with a third fixed contact, *S'*, placed half way between the first two. This produces a flash at either *a* or *b*, and from the indicator deflection it is possible to tell which one, that is, whether it is the maximum high side *(a)*, or maximum low side *(b)*. With contactor *m* in this position, the angle *d* between the dial indicator and contactor *m* is measured. Upon shutting the machine down, the actual high side in the rotor is found by laying off angle *d*, measuring from contact *S'* on the shaft.

The method here described is simple, positive, and easy to use. It has been applied in the study of vibration on a number of large machines.

Automatic pH Control Converts a Batch Process to Continuous-flow

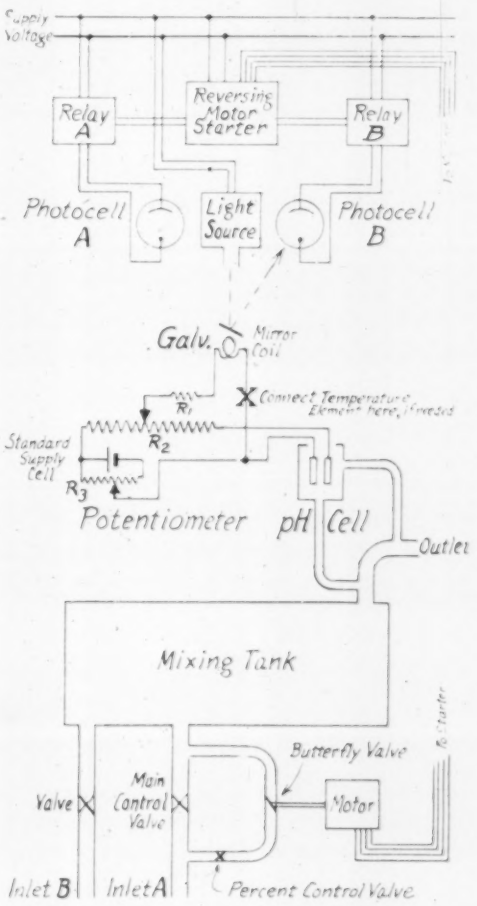
Awarded a Fifth Prize in the Third Annual Instrumentation Contest

By CHARLES E. DIEHL
Toppenish, Wash'n

"Born in Utah, educated in Salt Lake City High School and University of Utah. Financed way through by working alternate years as electrician. Education was in chemistry and electricity. Total use of chemical education was one year of chemical research with the American Smelting and Refining Co. Since then, mostly Chief Electrician on construction of metal mills, coal mines, power plants and sugar factories. At present Chief Electrician of Utah Idaho Sugar Co., with which company, intermittently, a total of over 14 years. World War vet., mem. Am. Legion. Hobby, study of electrical instruments and attempt at design of new types and new uses. This hobby fills corners of the house with junk and drains the pocketbook."

MANY chemical reactions have their end point characterized by a constant value of hydrogen-ion concentration. Batch production is often controlled by using a pH indicator of some kind, but batch or one-tank-at-a-time production is slow compared with continuous flow methods where two or more ingredients are mixed by passing through a tank slowly enough to produce complete reaction. Control of this type is manual and subject to the erratic results of that class of operation. Both analytical and electrochemical indicators are used in the continuous flow work. (Leeds & Northrup pH recorder, Central Scientific Co. colorimetric methods, etc.)

Where more than two chemicals are used that enter into the complete reaction, more than one operation is necessary in continuous flow work if automatic control is to be effective. This results in a production line effect from raw materials to the finished product, each step of which may be automatically controlled. Control is achieved by passing a small sample of the completed reaction through an electrode bowl which indicates by the potential developed therein the pH which registers on a more or less standard potentiometer circuit. The potentiometer's galvanometer, in turn, is the control for any desired percent plus or minus, of the flow of one chemical entering the reaction. By varying the sensitivity of the galvanometer and the percent of the whole flow of liquid that is controlled, stable operation is achieved. The desired pH to be arrived at is under control of an operator or chemist who has only one adjustment to make to alter this value to any other value which will then be maintained.



Standard potentiometer circuits are used, either with or without temperature correction. This correction is unnecessary in most cases as the rule is constant temperature automatically maintained in most reactions in which a uniform product is desired.

The instrumentation problem is that of opening or closing a valve or valves without imposing any load on the galvanometer and yet have this galvanometer control the valve movement. Mechanical means were obviously impossible. The photoelectric cell was the final means chosen, with the actuating light furnished by reflection from the galvanometer mirror. Relays in conjunction with these photocells control a motor reversing line starter with the motor geared to the valve to be moved. Time of operation of this valve is a bit critical and is a function of mechanical speed reduction only. Little power is required here, as the valve is a butterfly by-pass and the pressure difference is not great.

Operation as shown in the diagram is general only. No attempt is made to show actual mechanical construction. However, it is a technically correct flow sheet. A constant pH in solution will, with proper electrodes, give a constant emf. This emf. is generated in the electrode cell through which a small portion of the finished reaction flows. First we establish the desired pH and balance R_3 which adjusts the potential of the supply to equal that of the electrode cell. As the two cells are hooked negative to negative and positive to positive through the network of the potentiometer and the galvanometer, no interchange of current takes place and the galvanometer centers. Any deviation of the pH in the electrode cell produces a change in potential and current flows through the galvanometer. Deflection of the coil moves the mirror and the light strikes the photocell which may be photocell B, closing relay B which in turn closes the motor reversing starter to start the motor in the desired direction. The butterfly valve is then changed in position to either increase or decrease a portion of the flow of inlet A to the mixing tank. Constant flow of other ingredients being maintained at inlet B, the proportion of mix is changed directly by the change of pH of the finished product.

R_1 controls sensitivity of the galvanometer. R_2 is the potentiometer resistance and requires one calibration adjustment only. R_3 is the laboratory control and is varied to suit the desired pH in the product flowing through the electrode cell.

Semi-oscillation of the butterfly valve is constant. These minute changes of position of the valve average up and a constant pH control results. Overall variation of the finished product of the controlled reaction is much less than the individual variations between separately produced and controlled batches. The speed of production is practically doubled for the same tank capacity and same piping systems.

Where there is a deviation of temperature in any reaction where an electrode potential is used to indicate the pH of a solution, it becomes necessary to place a thermocouple in the electrode cell. This thermocouple is in series with the galvanometer and balances the variation in potential of the electrode cell due to temperature changes. Such a connection is made at X in the diagram.

Automatic Safety in Production Testing

Awarded a Fifth Prize in the Third Annual Instrumentation Contest.

By EDWIN E. TEACH
Ingersoll-Rand Co., Painted Post, N. Y.

PURPOSE of the automatic system to be described is to provide protection to machinery being "run in" for test purposes without attendance; and to provide a means for determining friction horsepower after the running-in period.

An important factor in the manufacture and operation of rotating and reciprocating machinery is the friction between moving parts. The operating efficiency of many types of machines is given considerable attention by industry today. Since a reduction in the loss of horsepower due to friction improves the efficiency, it becomes necessary to make careful studies to control this kind of loss.

The measurement of friction horsepower is a comparatively simple problem for the research staff of any competent engineering group. However, when it is desired to determine the friction horsepower of every unit in production, the time for measurement, the cost of this operation, and the inconvenience to production must all be given careful consideration. The writer designed an automatic arrangement using standard control equipment listed in the catalogues of various manufacturers. This control is suitable for use with any rotating and reciprocating machinery such as natural gas, gasoline, and oil engines, steam engines, compressors, or any units which can be arranged so that the machine can be driven externally either through a coupling or by a belt-wheel.

The actual friction horsepower is kept to a minimum by proper lubrication of the moving parts. During the period of "running in" the friction horsepower may be measured and used as a general index to determine if lubrication is adequate. The control devised for this testing is arranged to give absolute protection to the machinery being "run in." This protection eliminates the necessity of an operator on duty and reduces the cost of testing.

DESCRIPTION

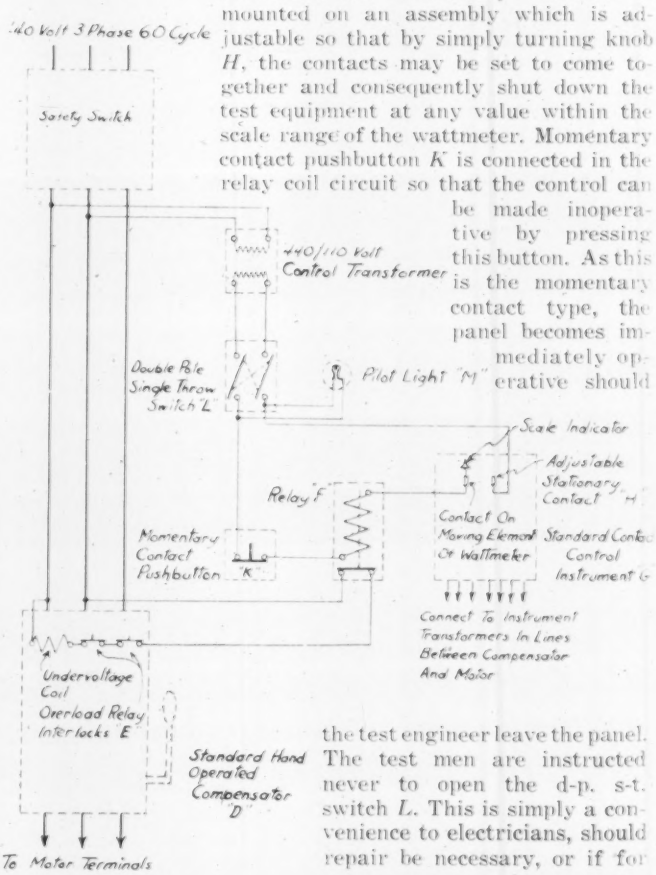
Motor *A* is belted to line shaft *B* which has several belt wheels *C* spaced evenly over the test floor. There is a belt wheel for each unit so that all of the machines tested are

Born in St. Paul, Minn., in 1915, Mr. Teach obtained his high-school education in Chicago. B.S. in E.E. Iowa State College, 1935. Eta Kappa Nu, Tau Beta Pi, Phi Gamma Delta. Having concentrated his college efforts on electrical power machinery, he entered this branch of engineering upon graduation, joining Ingersoll-Rand. After several months' training at the main I-R plant he was put in charge of the electrical engineering dep't of the I-R factory at Painted Post, N. Y. Principal work of dep't: application of motors and control to all types of air compressors.

driven by motor *A*. Current to the motor is supplied through the manual reduced voltage starter *D*. The interlocks *E* of the overload relays of the starter are connected in series with a normally-closed relay *F*. Standard contact-making wattmeter *G* is connected in the line between the starter and the motor. When the motor is running, the power to the motor is indicated on the wattmeter. The contact in the wattmeter is arranged so that when the power required exceeds a certain value, a circuit is completed to relay *F*, opening the overload relay circuit which deënergizes the undervoltage coil in the starter and this takes the motor off the line. The tripping value is adjusted by turning adjustment knob *H*.

Since the standard contact-making wattmeter is furnished with contacts which are not suitable for voltages over 250, a control transformer is used to reduce the voltage in the contact circuit to 110 volts. The contacts complete a 110-volt circuit to relay *F* and the normally-closed contact of relay *F* opens the under-voltage coil circuit of the standard compensator to shut down the motor whenever the contacts in wattmeter *G* come together.

In the wattmeter, one contact is mounted on the moving element. The stationary contact is mounted on an assembly which is adjustable so that by simply turning knob *H*, the contacts may be set to come together and consequently shut down the test equipment at any value within the scale range of the wattmeter. Momentary contact pushbutton *K* is connected in the relay coil circuit so that the control can be made inoperative by pressing this button. As this is the momentary contact type, the panel becomes immediately operative should


440 Volt 3 Phase 60 Cycle
Safety Switch
440/110 Volt Control Transformer
Double Pole Single Throw Switch L
Pilot Light "M"
Scale Indicator
Adjustable Stationary Contact H
Relay F
Momentary Contact Pushbutton "K"
Contact On Moving Element Of Wattmeter
Standard Contact Control Instrument G
Connect To Instrument Transformers In Lines Between Compensator And Motor
Undervoltage Coil
Overload Relay Interlocks E
Standard Hand Operated Compensator D
To Motor Terminals

the test engineer leave the panel. The test men are instructed never to open the d-p. s-t. switch *L*. This is simply a convenience to electricians, should repair be necessary, or if for

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some other reason it is desired to disconnect the control for a definite period. Pilot light *M* is a tell-tale that the panel is in operation and the head of the Test Division never runs machinery on the test beds unless this light is on.

OPERATION

After the Test Division has set up the proper number of machines on the test beds, the motor is started. During the starting period, the test engineer presses pushbutton *K* to keep the control inoperative until the motor is up to speed. After the motor is up to speed, the wattmeter indication will drop off slowly as the oil works into the moving parts. Matching this drop in load gives the test engineers a picture of the time required before lubrication has its full effect. This is one of the important features of this control.

The next step is to set the stationary contact for the tripping valve. No tables must be consulted nor calculation need be made as the operator simply looks at the scale indicator and sets the tripping valve slightly above the operating wattage as indicated. This simple operation is a great benefit when testing machines being produced in quantity. Any abnormal condition prior to setting the tripping value is immediately apparent since the operator through experience knows roughly what the indicated kw. should be. Experience has shown that the tripping value can be easily adjusted to be only 2% above the operating load. This certainly affords much more protection than given by the common overload relays as used in industrial control apparatus.

CONCLUSION

This control equipment is well adapted for production testing since the friction load can be determined on each machine independently by simply putting the belts on or off the individual units. A group of units may run simultaneously to wear in the moving parts prior to the final friction load measurements. During the running in period which can be arranged during the night for a 16-hour run, no operator is required, yet the machinery is fully protected. The slightest increase in friction load due to improper assembly of the machinery, breaking down of the lubrication qualities of the oil, or any other cause, will result in immediate shut-down of the test beds. Since the control is actuated by a wattmeter and not by a current-sensitive relay, a small variation in voltage during the night or running-in period will not result in a shut-down.

The writer designed the layout of this equipment and was responsible for its installation in a plant engaged in the manufacture of heavy machinery. The control has met with great success in production testing at this plant and is in 24-hour service. The ease of operation, extreme accuracy, complete protection, and low installation cost are the chief advantages. Engineers seeing this installation have often commented that even if the control shuts down the test beds only once, the saving to the plant in avoiding damage to the machinery will more than pay for this control arrangement.

Scratch Hardness Test for Case Depth

Awarded a Fifth Prize in the Third Annual Instrumentation Contest.

By DONALD F. CLIFTON

Michigan College of Mining and Technology, Houghton, Mich.

IN testing materials it often is necessary to determine the variations in hardness of the specimens, especially in determining hardenability and in working with cases of different kinds. The conventional method of making these determinations is to take a series of hardness readings on a cross section of the specimen, using a Rockwell or similar hardness tester. This method is tedious, and because of the distance between impressions it is inaccurate—especially with thinner cases. It is practically useless with cases as thin as those on carburized and nitrided steel.

The instrument described herein was built to check visual measurement of the thickness of nitride cases by hardness readings. It has given reliable readings where the other type machine would not; and it has proved faster.

The surface preparation for scratch testing is necessarily greater than for single-indentation testing. A micro polish is required for accurate work, but for rougher work, such as hardenability determinations, finishing on a medium polishing belt seems to be satisfactory. Too little work has been done with the larger specimens to be sure of the finish required for different degrees of accuracy but all tests so far seem to indicate that greater speed is obtainable with specimens to 2" in diameter, and both speed and accuracy are increased with small specimens. With the nitrided specimens thirty-five were taken from a state satisfactory for testing on the Monotron, polished, etched, and hardness tests made in slightly over two hours, which is about the time it would have taken to run them on the

"I was born in Pella, Iowa, in 1917 and got my elementary and high-school education in Peoria and Hinsdale, Ill. I entered Antioch College in 1935 as a chemical engineering major and worked part time as an electrician. I had to leave school in the middle of my sophomore year due to illness. The next summer, while working, I decided to change my major to metallurgy so transferred to Michigan M&T instead of returning to Antioch. Graduated in 1940 (B.S. in Met. Eng.). I did research work on the nitriding of steel (which led to the development of the hardness tester) until December (after closing date of contest) when I went to work in the laboratory of the Globe Steel Tubes Co. in Milwaukee."

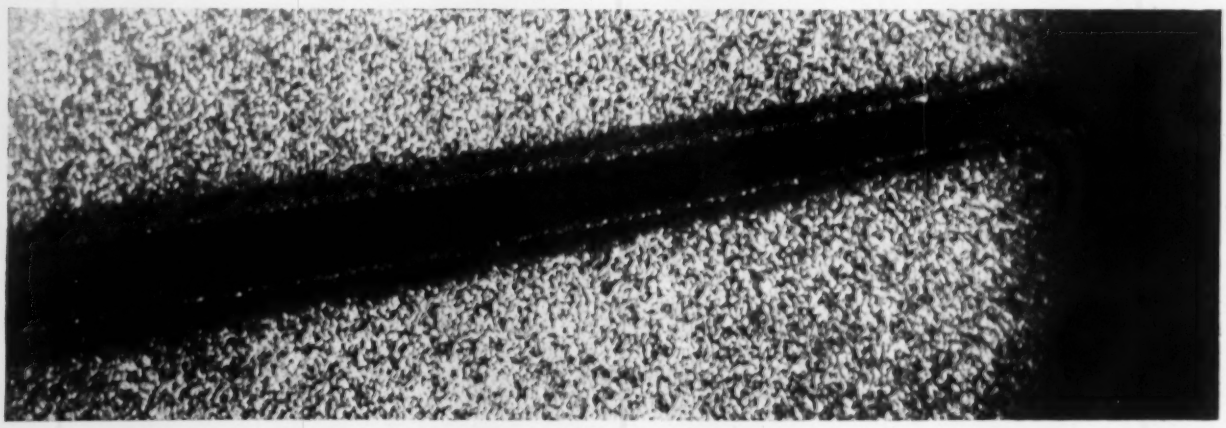

Fig. 1. 100 ×

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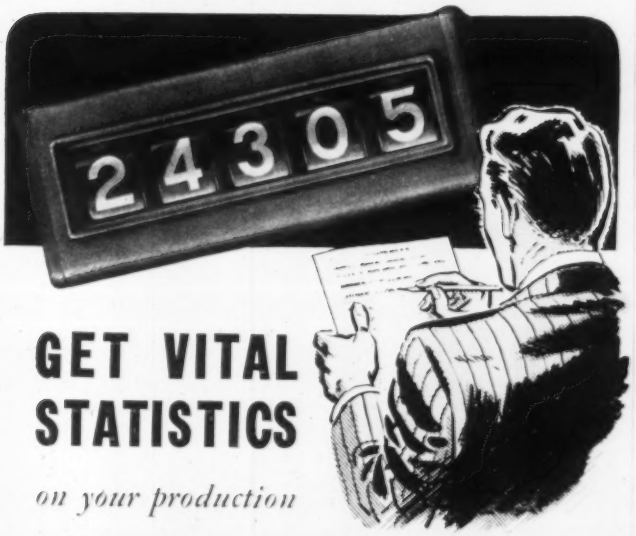

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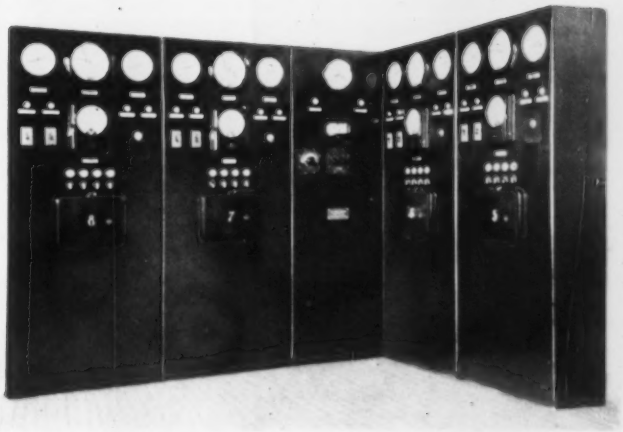

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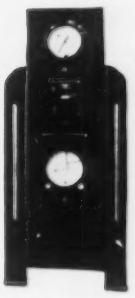

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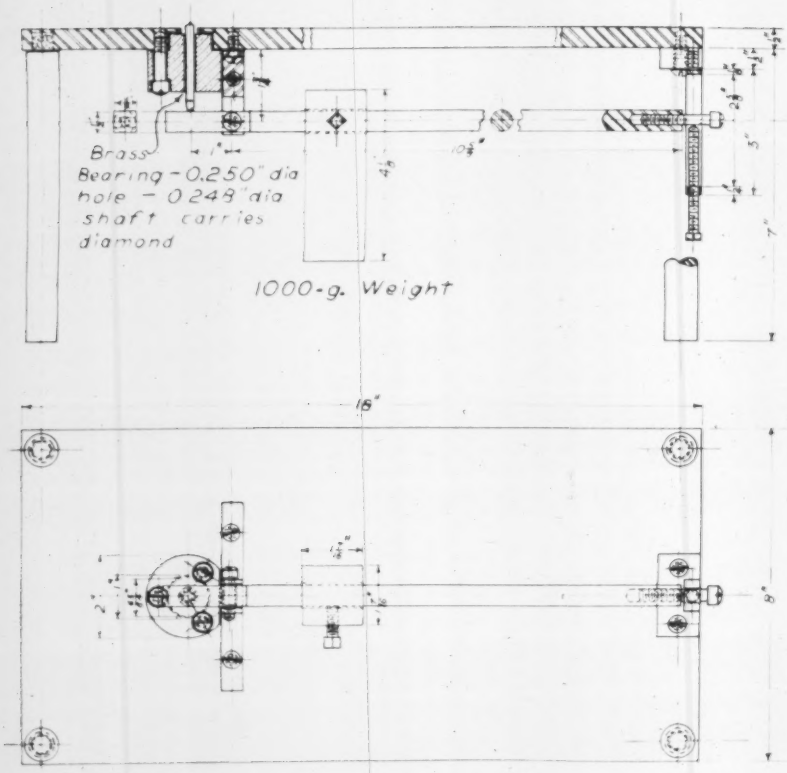
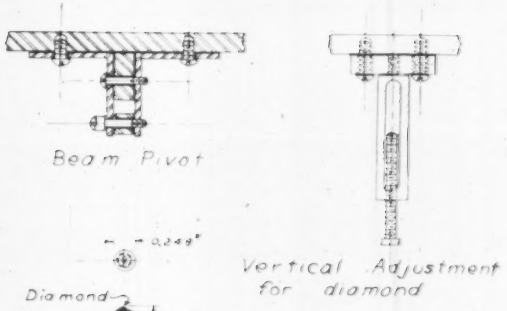
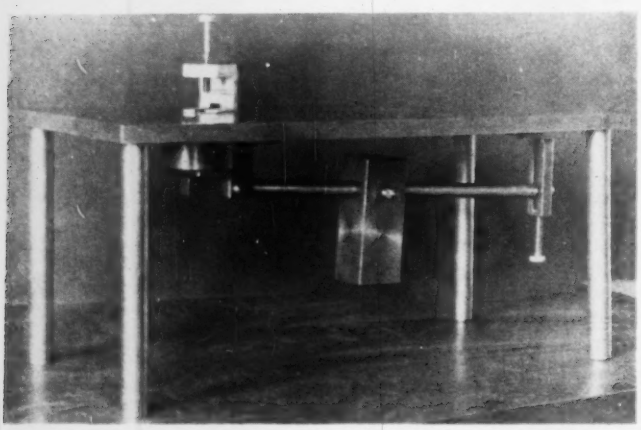






Monotron. By testing after polishing on fine metallographic paper, this time could have been reduced by perhaps 45 minutes with little effect on the accuracy obtained.

Fig. 1 shows the scratch on one of the specimens at 100×. This case has been ground through at an angle, so the apparent thickness is three times the actual thickness of 0.015". The point where the case begins and the scratch starts to narrow is not as clear in the picture as it appears on visual observation, but the rather rapid narrowing in the inner part with less decrease in width near the edge shows well the rather uniform hardness of the case near the surface of the piece, the decrease farther below the surface, and a final transition to the soft core material.

In thin-case specimens of this type it is possible to measure the case thickness with a micrometer eyepiece on the microscope, since the entire case is in the field. With hardenability specimens the inner edge of the case must be found and marked under the microscope and the depth of the hardened case measured with a ruler.

The hardness tester is quite simple; although it was built as a permanent addition to the testing laboratory it was made as simply and as cheaply as possible.

The diamond itself is a small jewel obtained from the local jeweler and is mounted in a steel shaft, as shown in the drawings. The sharp edge, not the vertex, of the diamond forms the cutting point. The shaft is hollow, the diamond protruding through a small hole in the upper end, and held in place by a rod extending through the shaft from the plug screwed into the lower end. The bottom of this plug is carefully rounded to reduce friction on the flat surface of the beam on which it rides. The entire mechanism of the tester is fastened to the under side of the $\frac{1}{2}$" steel plate which forms the top of the table of the tester and through which the diamond extends. The top of this plate is polished to avoid unnecessary scratching of the specimens as they are pushed across the diamond. The legs are $\frac{3}{4}$" rods, and the assembly is heavy enough to be used without being fastened down.

The shaft carrying the diamond is 0.248" in diameter and slides in a 0.500" hole bored in the brass bearing. This bearing is $1\frac{3}{8}$" long and is countersunk to within $\frac{1}{8}$" of the top of the table. It is held in place by three bolts through the shoulder on the bearing, and tapped into the table top. No tapped holes in the table top extend through it.

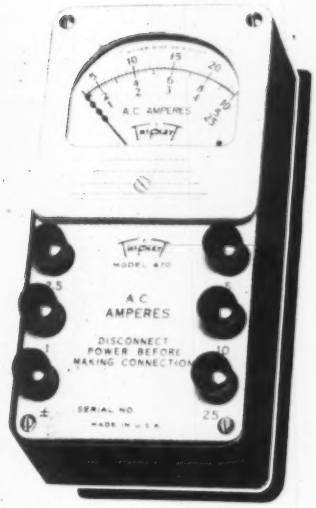
The beam carrying the weight for loading the diamond is mounted on a frame made up of two pieces of steel angle with a block of steel fastened between them to keep the correct clearance between the arms so the beam will not bind. This assembly is bolted to the under side of the table just behind the bearing.

The beam itself is pivoted on a $\frac{1}{4}$" smooth shank bolt through a $\frac{17}{64}$" hole in the beam, which is $\frac{1}{2}$" square but turned round for $10\frac{1}{4}$" from one end for the round hole in the weight. The pivot of the beam is exactly one inch from the center of the diamond, so that with a 1-kg. weight 10" from the pivot a load of 10 kg. is obtained. This load is somewhat in excess of that needed for any specimen so far encountered, but the 1-kg. weight can easily be replaced by a smaller one for soft material. Having the correct load on the diamond is important in getting the best possible results.

The weight is of steel, $\frac{17}{16}$" square and $4\frac{1}{8}$" long. It has a hole for the beam to pass through, and a setscrew is tapped in from the side to hold it in any desired position.

At the rear end of the beam is an adjustment controlling the height of the diamond in relation to the table so that it can be raised to allow the use of a specimen holder and to allow for irregular surfaces. This adjustment consists of a bar with a vertical slot in which slides a bolt tapped into the end of the beam. Through a tapped hole in the bar a bolt extends up through the slot, limiting the distance the beam is free to drop. The slotted bar has a threaded lug at the upper end which screws into a tapped hole in a block. This block is bolted to the underside of the table so that the entire assembly can be readily removed, allowing the weight on the beam to be changed.

Most of the dimensions can be varied to suit the material at hand. The ratio of 1" to 10" on the beam has been found satisfactory not only because it allows ample variation in the load but also because the vertical movement allowed the diamond is sufficient without making the vertical adjustment overly long.



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Model 675—0-1; 0-5; 0-10; 0-25; 0-100; 0-250; 0-500; 0-1000 DC Milliamperes.

Model 676—0-50; 0-100; 0-250; 0-500; 0-1000 DC Microamperes.

Model 677—0-1; 0-2.5; 0-5; 0-10; 0-25; 0-50; 0-100; 0-250; 0-500; 0-1000; DC Volts at 1000 ohms per volt.

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Speeding Up Gasoline Pipe Lines

Awarded a Fifth Prize in the Third Annual Instrumentation Contest.

By SELIG H. ISAACS

Instrument Engineer, Latonia Refining Corp., Covington, Kentucky

ADEQUATE supplies of gasoline and oil have become as important to armies and navies as ammunition and guns. Therefore, the equipment for moving refined products, in large volumes and without interruption, to their points of consumption has become as fundamental a necessity, in peace as well as in an emergency, as the actual production and refining.

For moving gasoline from refineries to central points for distribution, pipe-lines represent the fastest, most efficient and most dependable method of transportation. Some of the advantages of pipe-line handling as compared to tank car or tank truck movements are as follows:

1. Higher speed of transfer.
2. Elimination of loading and unloading labor.
3. Increased efficiency in: (a) lower power requirement per unit transferred; (b) elimination of the loss of some high octane number volatiles which always accompanies loading and unloading of tank cars and tank trucks.
4. Greater certainty of delivery.

It must be remembered in connection with Item 4 above that probably during a heavy armament program, and certainly in case of war, railroad and highway facilities will be taxed to the utmost. A system of handling large-volume gasoline movements separated totally from other transportation facilities would eliminate one of the most pressing problems that would confront those in charge of decisions on priority shipments.

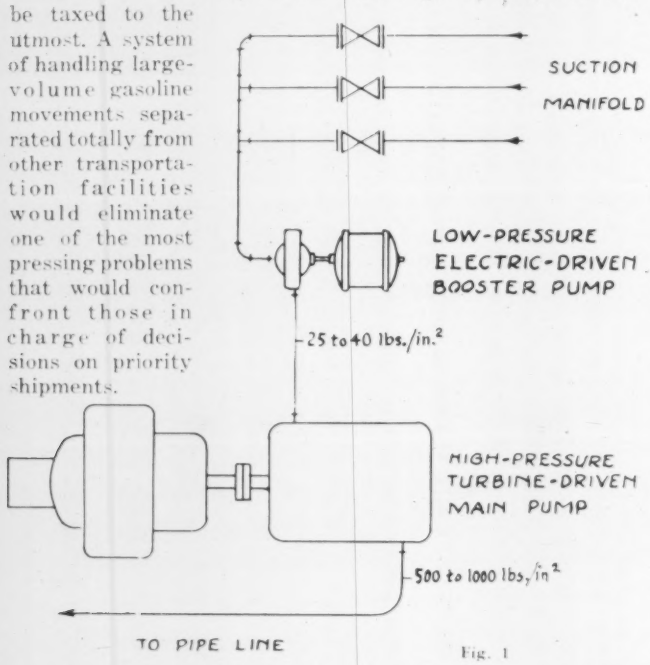


Fig. 1

It is a peculiar trait of pipe-line transportation that once a transfer has been started, no attention is required so long as operation is normal. But let some accident occur and in a few moments damage can be done that is not only costly but requires much time to repair. For these reasons large volume handling of gasoline by pipe-line was not found to be practical without proper instrumentation to control the pumping equipment. Pipe-line engineering therefore has become not only a problem of proper selection of pumps, valves, and pipes, but of automatically controlling the operation of the equipment so that in every way possible the line will be protected against damage.

Some of the operating troubles that can occur are as follows:

1. A broken line. Particularly serious when the line runs through heavily populated areas, as is often the case.
2. Accidental shutting of a valve at the receiving terminal while the transfer pumps are running, which of course can cause serious damage to the pumps.
3. Loss of suction by the pump. Serious when centrifugal pumps are used, which is normally the case.

There are other remote, but equally serious possibilities.

To protect and insure the continuous operation of its pipe line from the refinery to distributing points in Ohio the Latonia Refining Corp. has installed protective instrumentation which will be described.

Since he was graduated from the Dep't of Chemical Engineering of the University of Cincinnati in 1936, Mr. Isaacs has been with the Latonia Refinery of the Standard Oil Co. of Ohio, where for the past three years he has been in charge of Instrument Maintainance and Engineering. He was active in the organization of a Junior Chapter of the Engineers' Club of Cincinnati and served as president of that group during its first year of existence in the winter of 1938-39. He is registered as a Professional Chemical Engineer with the Ohio Board of Registration for Engineers.

Fig. 1 shows schematically the equipment in the refinery terminal of the line. An electric-driven single-stage low-head high-volume centrifugal pump pulls from any one of several tanks through a suction manifold and delivers gasoline to the main pump at a pressure of 25 to 40 lbs./in.^{2}. The main pump, a multiple-stage steam turbine-driven centrifugal, receives the material from the low-pressure pump and delivers at a pressure of 500 to 1000 lbs./in.^{2} depending on the rate of flow and the distance to the terminal to which delivery is being made. This main pump discharges directly to the pipe line.

Fig. 2 is a diagrammatic sketch of the control instrumentation. In this figure Item 1 is a 0 to 100 lbs./in.^{2} pressure recorder which measures the suction pressure to the main pump as produced by the single stage pump. Item 2 is a 0 to 1500 lbs./in.^{2} pressure recorder which measures the main pump discharge pressure. Item 3 is a recording orifice type flowmeter which measures the rate of flow of gasoline to the pipe line. These three instruments contain on-and-off air-operated control mechanisms connected in series so that the controlling (or diaphragm-motor) air pressure from Item 1 becomes supply pressure for Item 2, and the controlling air from Item 2 becomes supply pressure for Item 3.

Item 1 has a standard on-and-off control mechanism arranged so that when the pressure pen reads higher than the control point index, 15-lb. control air pressure is delivered to Item 2, and when the measured pressure is lower than the control point index, zero pressure is delivered to Item 2. Instruments 2 and 3, however, are equipped with *two* control point indices. These are so arranged that the pressure pen on Item 2 must stand between these two control point indices before the 15-lb. control air pressure is delivered by the instrument to Item 3. If the pressure-measuring pen is either above or below both control point indices, zero control air pressure is delivered. This is also true of the flow pen on Item 3, which must stand between its two control point indices before the full 15-lb. control pressure is transmitted to the remainder of the control air system.

All control point indicator arms are equipped with recording pens so that a record is kept of the control point settings.

From Item 3 the control air is connected to four separate diaphragm motors shown on Fig. 2 as Items 4, 5, 6 and 7. Diaphragm 4 operates a mercury switch so that when there is zero air pressure on the diaphragm the circuit is closed to a signal horn motor. Diaphragm 5 contains-

a second mercury switch which energizes the starter switch holding coil of the electric-driven low-pressure pump when there is 15-lb. pressure on the diaphragm. Item 6 is a flat seated double-port valve in the steam line to the main pump turbine drive which is held open by 15-lb. pressure on its diaphragm. Item 7 is a single seated ¼" valve in the air supply line to the controllers, which is held open by 15-lb. on its diaphragm.

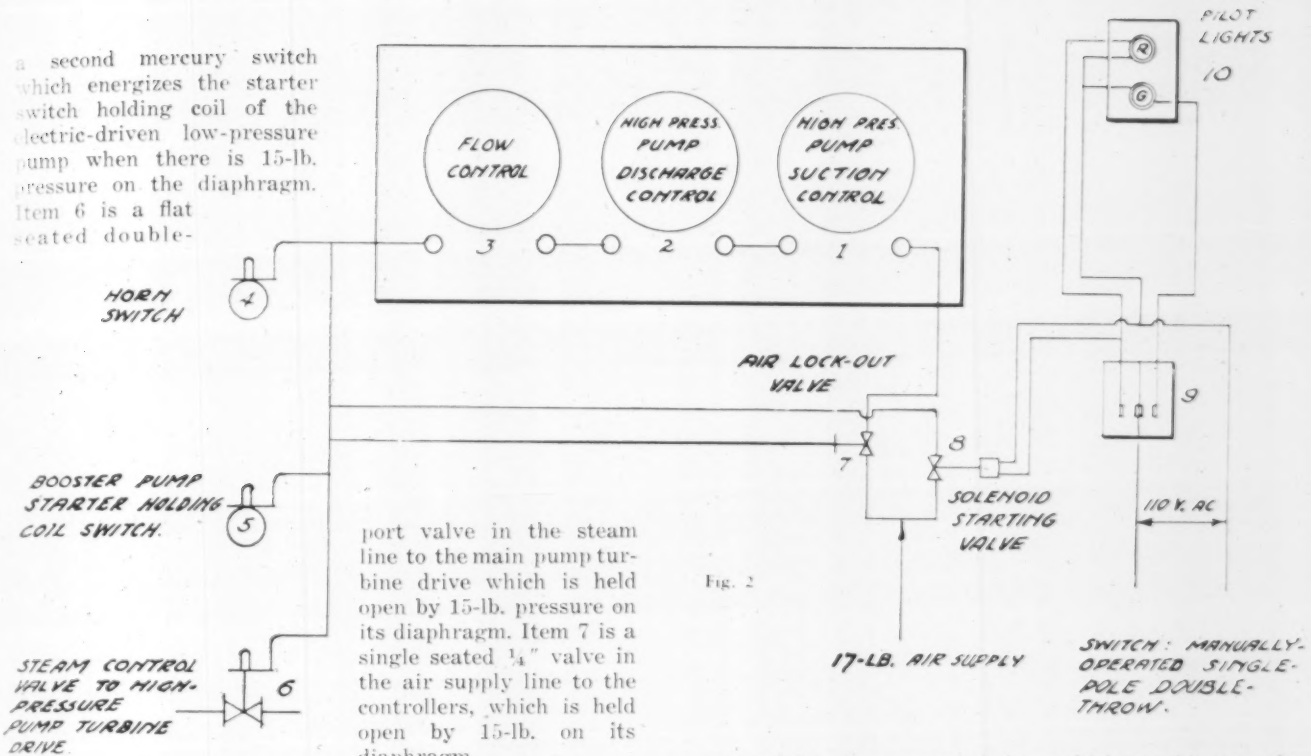


Fig. 2

In order to start pumping it is necessary to throw switch 9 to the position which lights the red light of the pilot light panel (Item 10) and closes the circuit to solenoid-operated air valve 8. Closing this circuit opens valve 8 and by-passes control air pressure around the controllers 1, 2 and 3. This shuts off the signal horn circuit at 4, energizes the starter holding coil at 5 and opens the turbine steam valve at 6. Under these conditions it is possible to start all the pumping equipment just as if there were no controls at all. As soon as the measured pressures on Items 1 and 2 and the flow on Item 3 have come to their normal operating values the control point indices are adjusted on the three controllers. On Item 1 the control point is set about 15 lbs./in.^{2} below the measured pressure. On Item 2 one control point index is set 100 lbs./in.^{2} below and the other 100 lbs./in.^{2} above the measured pressure. On Item 3 one control index is set about 10% below and the other about 10% above the flow. This means that the pressure pen on 1 is above its control point index; and the pressure pen on 2 and the flow pen on 3 are between their respective control point indices. This fulfills the conditions already described for causing each controller to deliver control air pressure at 15 lbs./in.^{2}. It is then possible to throw the switch at 9 so as to light the green pilot light at 10 and close valve 8. So long as the pressure pen on 1 remains above its control point index and the pressure pen on 2 and the flow pen on 3 remain between their respective control point indices there will be 15-lb. pressure on all the four diaphragms. Under these conditions both pumps will run and the horn will be silent. Should any one of these conditions no longer hold true, air will be released from the diaphragms. This would shut down both pumps, sound the horn and close the air lock-out valve 7. It is then impossible for the controls to function and permit operation of the pumps until the operator manually throws the switch at 9 to open the control air by-pass.

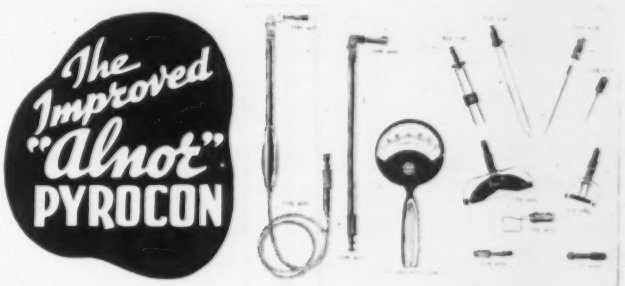
It is now possible to return to the list of possible pipe-line accidents previously presented and analyze how the control system would react to each.

1. A line break would cause a pressure drop at the pump which would be sufficient to move the pressure pen of Item 2 below its low control point index, which would shut down the pump.

2. A valve shut against the running pump would stop the flow and cause the control to operate from the flow instrument.

3. Loss of suction would be indicated by a pressure drop, on the low-pressure controller, sufficient to move the pressure pen below its control index, which would stop the pumps.

Because of this control unit it is possible to operate a high-pressure pipe-line with safety to equipment, operating personnel, and communities through which the line may run. At the same time a minimum of attention is required. The Gasoline Pipe-line thus becomes a completely practical unit and can take its important place in the scheme of peacetime operations and National Defense.



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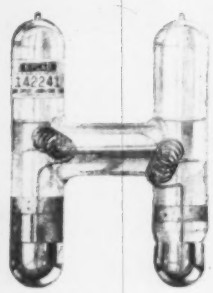

For more than 20 years the leading American manufacturers of industrial temperature control apparatus have used Eppley Standard Cells in their recorders, pyrometers and other instruments utilizing the potentiometric system of measurement.

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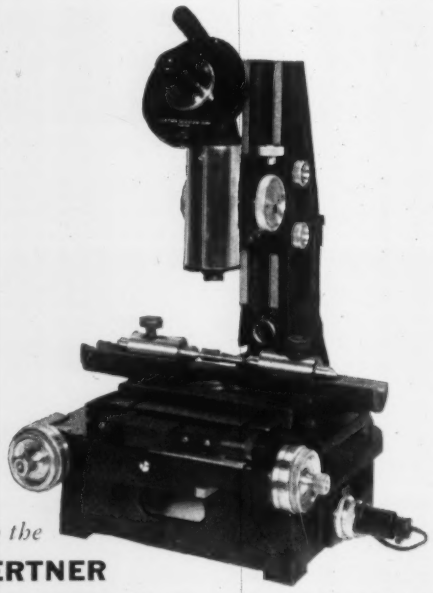

With the
GAERTNER
TOOLMAKER MICROSCOPE

Descriptive Bulletin on Request
THE GAERTNER-SCIENTIFIC CORP.
1211 Wrightwood Ave., Chicago, U.S.A.

Rapid Method of Determining Case Depth

(Concluded from page 8)

Cyanide case hardening Material used: S. A. E. 101 3/32" thick—heated to 1475° F.—quenched in oil

Thickness of case in inches	*Penetor surface reading*
Annealed	37
0.0015	65
0.0025	70
0.003	74

Note the extreme sensitivity of the Penetor to small dimensional differences in case thickness.

Liquid carburizing Material used: S. A. E. 1112 ¼" thick—heated to 1540° F.—quenched in oil

Thickness of case in inches	*Penetor surface reading*	*Penetor depth reading*
Annealed	35	..
0.002	59	..
0.005	74	39
0.015	87	52
0.025	88	62

After a certain saturation of the surface by carbon a deeper penetration of magnetic flux is necessary to indicate case depth and consequently it is advisable to use the Penetor depth reading for measuring thicker cases. Similar results are obtained with all other forms of carburizing.

Detection of under and over heat on cyanide case hardened parts Material used: S. A. E. 1015 3/32" thick—depth of case 0.003"

Quenched in oil at	*Penetor surface reading*
1400° F.	72
1525° F.	76
1600° F.	87

Hardening and tempering of high-speed steels

	Penetor surface reading	*Penetor depth reading*
Heated to 2300° F. quenched in oil	85	85
Tempered at 1050° F.—3 hrs.	72	58
Same sample as above held at quenching heat too long	90	

This table illustrates a great difference in Penetor readings for tempering heat, which is not as prominently indicated by identation test methods. Also note the increase in Penetor readings due to soaking H.S.S. too long. This error is known to result in coarse carbide network and brittleness.

Hardening and tempering of spring steel
Material used: 80 carbon spring steel 0.006" thick

	Penetor depth reading
Annealed	18
Heated to 1475° quenched in oil	91
Tempered at 250° F.	87
300° F.	85
350° F.	81
400° F.	75
500° F.	45
600° F.	34

The sudden drop in Penetor readings between the 400° F. and 500° F. temperatures is also evident in some physical tests. A continuous test of rolls of spring steel may be taken automatically.

SURFACE DECARBURIZATION OF TOOL STEELS

Many tool failures are directly traceable to the insufficient removal of surface stock of tool steel before hardening. The Penetor is invaluable in determining this variable amount; decarburized stock is removed until the surface reading corresponds to the core reading.

CONCLUSION

The Penetor, which has been described, will contribute appreciably to the flawless production of aircraft motors and other Ordnance supplies and should be a welcome addition to instruments which play such an important rôle in speeding up our National Defense.

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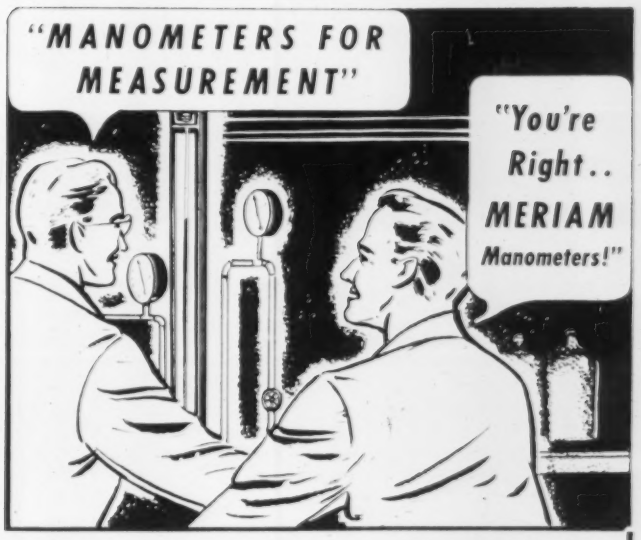

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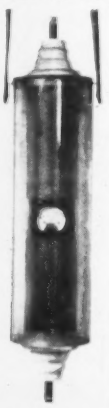
NEW INSTRUMENTS

Dial Test Indicator

New "GS" Dial Test Indicator is characterized by a simplified lever movement. Instead of the usual rotating multiple gear and pinion trains, the GS indicator utilizes a lever arm. It is said to be constructed on the principle that "the simpler the mechanism the greater will be the accuracy and durability of the tool." Dial is graduated in 1/1000" with a plunger travel of 3/16". Indicator can be supplied with universal ball joint back which permits a wide range of indicator settings on all types of machines. Indicator movement is mounted between separate top and bottom plates; and hair spring is mounted between two flat plates and cannot interfere with the lever rack. Plunger is hardened and ground and has nickel-silver bearing.—*George Scherr Co., 128 Lafayette St., New York City.*

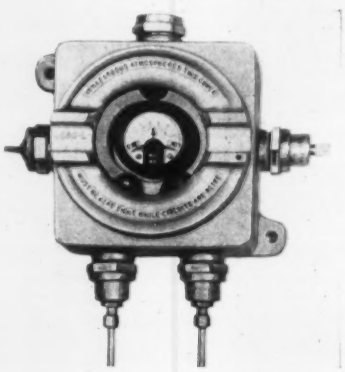
Phasing-out Voltmeter

New portable high-resistance voltmeter for approximate indications of kilovoltage has been developed for higher voltages (up to 15 kv.) than those now handled by the maker's similar 5-kv. voltmeter (*Instruments*, Dec. 1938, page 292). Designed particularly for phasing-out power distribution circuits, new instrument is also suitable for bus sectionalization, location of cable faults, and similar applications. New voltmeter is for use on 6900- and 12,000-volt circuits. It has a scale marked 0-15 kv., and is constructed to withstand 30 kv. momentarily since this voltage may be experienced when phasing out 15-kv. circuits. When used for phasing-out service, the instrument will show approximately zero voltage if the correct phase relationship is obtained, or will go off-scale, indicating an improper connection. Basically, it consists of a miniature instrument connected in series with a ¼-watt neon lamp and two high-voltage resistors.—*General Electric Co., Schenectady, N. Y.*



Explosion-proof Gas Alarm

New M.S.A. Explosion-proof Combustible Gas Alarm is for safely and continuously sampling atmospheres where combustible gases and vapors may be present. It provides instant warning when gas concentrations exceed a predetermined limit, and may be adapted for automatic process or ventilation control. New unit, including sampling pump, is contained in an Underwriters-approved explosion-proof conduit, and can be safely installed in gaseous atmospheres, obviating the need for long sampling lines. Instrument is specifically calibrated for the particular gas or vapor which it will test. Operator can adjust the measuring circuit to operate a warning signal at any predetermined point within instrument's range.—*Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.*

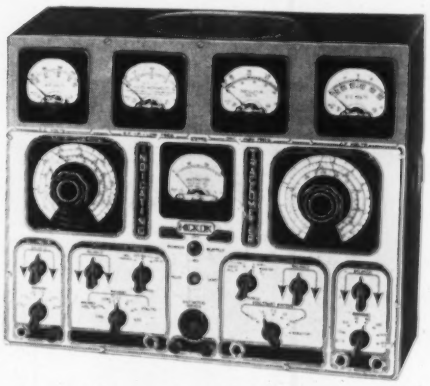


Computing Device for Electrical Work

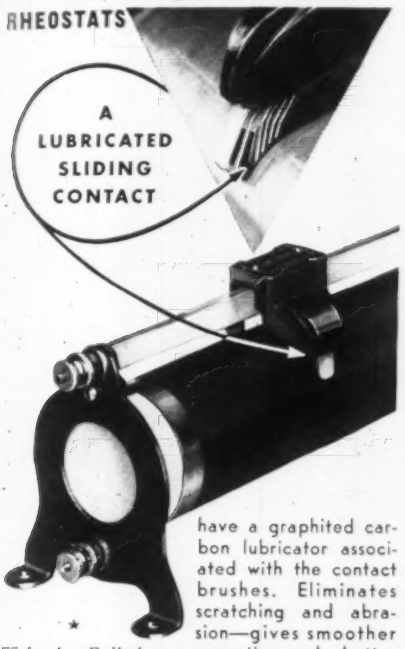
"Ohm's Law Calculator" is said to give the answer to any Ohm's Law problem with one setting of the slide. All values are direct-reading. Calculator does not require that user have knowledge of a slide rule. It has scales on both sides so as to cover the range of currents, resistances, wattages and voltages commonly used in the industrial, electronic, and radio fields. Calculator is available to engineers, laboratory men, production managers, maintenance men, purchasing agents, etc. who write to maker, on company letterhead, giving name and position. (Ten cents must be enclosed to cover handling costs.)—*Ohmite Mfg. Co., 4835 Flournoy St., Chicago, Ill.*

New Model "Traceometer"

Improvements embodied in new "Model 155" of "Traceometer" (see *Instruments*, Jan. 1940, page 26) include addition of a self-contained speaker internally connected for monitoring either r-f., i-f., or a-f. channels. It gives continuous measurement of voltages and traces the signal in any five circuits at one time without interfering with performance of the set being tested. Vacuum-tube voltmeter circuits are so arranged that accidental overvoltage cannot damage indicating instruments. All measurements are made without disturbing normal operation of circuit under test. New Traceometer is for rapid servicing for f-m., a-m, and television receivers.—*The Hickok Electrical Instrument Co., 10529 Dupont Ave., Cleveland, Ohio.*



JAGABI "Lubri-tact" RHEOSTATS



have a graphited carbon lubricator associated with the contact brushes. Eliminates scratching and abrasion—gives smoother operation and a better contact. Makes Jagabi Rheostats *better* rheostats.

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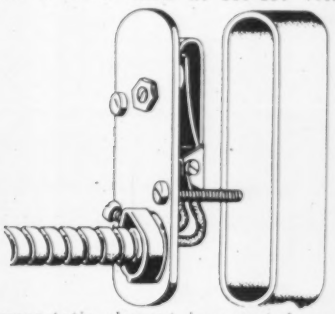
Surface Thermostat

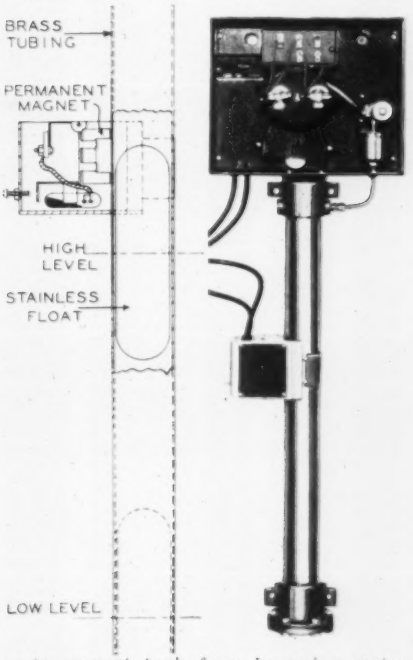
New "BX Strip Type Thermostat" is of heavy-duty design, comprising a thermostatic element suitable for electrical heater loads of 1500 watts at 115-230 volts a.c.



Thermostatic element is mounted on a removable cover to facilitate wiring. A ⅞" hole is provided in cover for BX cable connector, and two 10-32 mounting screws fasten both cover and base to any flat surface. Available in max. temperature ranges of 300°, 450°, and 700° F. Supplied with normally-closed contacts to open with rise in temperature; or with normally open contacts to close with rise in temp.; both being adjustable. Dimensions 4¼" × 1⅝" × 1".—*George Ulanet Co., 86 E. Kinney St., Newark, N. J.*

Combined Liquid Level and Pressure Controller

Though available separately, new "PW" and "PWD" controllers have been developed in response to demand for simple fool-proof system of controlling water level and air volume in pressure tanks in such manner



as to prevent tank from becoming waterlogged or air-bound; and as to permit utilizing tank's maximum capacity. At left is illustrated "PW" float column control alone; at right, combination of "PW" and "PWD"—latter shown with cover removed. Pressure element is identical with maker's "Roto-Trol," is of the springless, ball-bearing type. New level controller, available by itself, has a stainless-steel float and packless magnetic coupling utilizing an Alnico alloy magnet. Manufacturers emphasize that new controllers are particularly suitable, in their cycles of operation, for control of centrifugal pumps, deep well pumps, etc.—*Water Level Controls Co., 2255 University Ave., St. Paul, Minn.*

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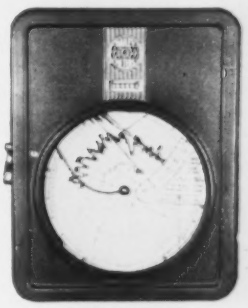

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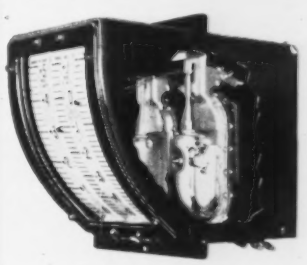

Multi-Pointer Gage

Flow Meters. For indicating, recording and integrating the flow of steam, feed water, compressed air and other fluids.

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SPECIAL ISSUE OF *Instruments* THE MAGAZINE OF MEASUREMENT and CONTROL

Vol. 14, No. 1
January, 1941
Price $2.00
In Two Parts

PART TWO—THE 1941 INSTRUMENTS INDEX

More Than a Directory

CONTAINING the answers to 99% of the inquiries which *Instruments* receives from subscribers, this Supplement may be likened to a set of phonograph records: it can only be "played" by a "pick-up." The simple "pick-up," which will place at your instant command a wealth of information, is merely your getting acquainted with this Supplement by READING THIS PAGE.

The Index Section—"Who makes what"—is the most important. Anyone who wants to know where he can buy or secure information on a certain product will find the product properly indexed and cross-indexed, and under it the names of the manufacturers and sole representatives.

Indexing System. Products are indexed under the main word. In cases where a name is ambiguous, or where the item is known under two or more names, companies making such devices are listed under one heading and cross-references inserted under the other headings.

Specific Terms. You never are in need of "a gage" but of some particular kind of gage. Therefore we do not list manufacturers under broad general designations. For example, we do not list any names under the main heading "Meters" but we give the sources of supply for numerous classes and types of meters. Moreover, we do not list any names under "Meters, Liquid" alone; but we give under proper subheads the sources of supply for the *class* and *type* of liquid meter you may need.

Trade Names. An effort has been made to remove all proprietary trade names from the Index Section.

Correctness of Headings. As explained above, main headings and subheads are technically correct. A few are not scientifically correct: they are names in common usage, recognized for the convenience of the majority.

Correctness of Listings. We have endeavored to list no firm names under specific headings unless the instruments made by such firms belong there by virtue of their design and construction.

For example, instruments called "colorimeters" but which cannot yield color specifications, belong under Color Comparators, Color Matchers, etc.

Also, an instrument called the "Integrating ————" or "Totalizing ————" may be nothing but a counting type, belonging under the subhead "Counting."

This we have done in relatively few cases, for it amounts to *censoring* the data sent to us. As a rule, we had to take the company's word that it could supply the product in question. We can't send "detectives" to a thousand plants!

Completeness. More than 1200 manufacturers were canvassed in the last four months. Those that did not answer our first letter after one month received a second one. Again, a third letter was sent to nonresponders at the end of the second month. In the last few weeks we even sent representatives to call on manufacturers. Therefore, the omission of any manufacturer's name under any heading is due to the negligence of someone in his own organization.

CONTENTS

1. *Index to Instruments and Apparatus.* **In this section, products are listed alphabetically. Under each heading appear the names of the manufacturers of this equipment (and of the sole representatives of such manufacturers).** *Pages 2-65.*

2. *List of the Laboratory Supply Houses.* **Under the heading "Apparatus, Laboratory," on page 5, are listed companies specializing in laboratory supplies, equipment, instruments and apparatus.**

3. *Directory of Manufacturers and sole representatives,* **with complete addresses and brief descriptions.** *Pages 66-75.*

Every effort has been made to restrict the names in the Index Section to (1) the actual manufacturers and (2) the sole authorized sales agencies. On the other hand, whenever you desire to order at one time a variety of equipment, made by different firms, you may find it most convenient to get in touch with a recognized, competent, "laboratory supply house." These houses are listed under "*Apparatus, Laboratory,*" on page 3.

Instruments' Further Service. This Index contains the answers to *only* 99% of your inquiries. If you cannot find the product or the name you want, communicate with the Information Section, Instruments Publishing Co., 1117 Wolfendale St., Pittsburgh, and every effort will be made to furnish the information promptly.

Suggestions. We shall appreciate suggestions regarding:

1. Headings not at present found in this Index which should be there,
2. Firms listed erroneously, and
3. Other inaccuracies which may have crept in despite all precautions.

Published Monthly on the 15th by

The Instruments Publishing Company
1117 Wolfendale Street Pittsburgh, Pa.

R. RIMBACH Managing Editor
M. F. BEHAR Editor

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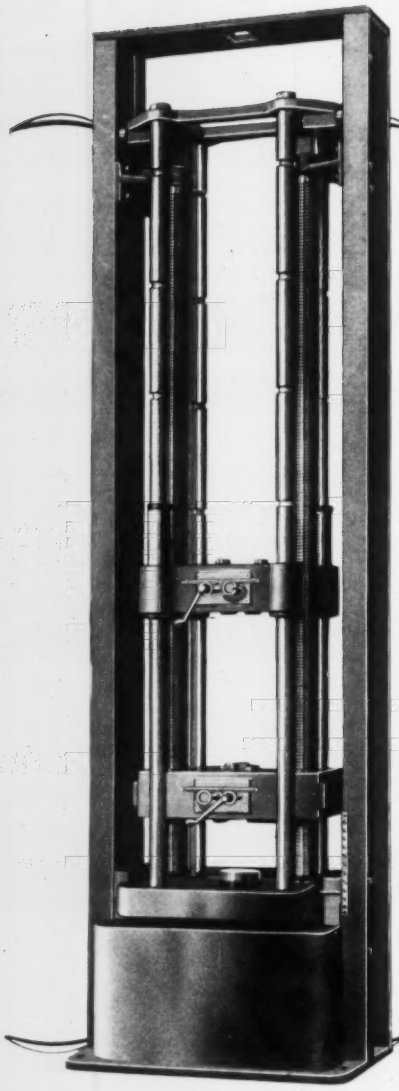

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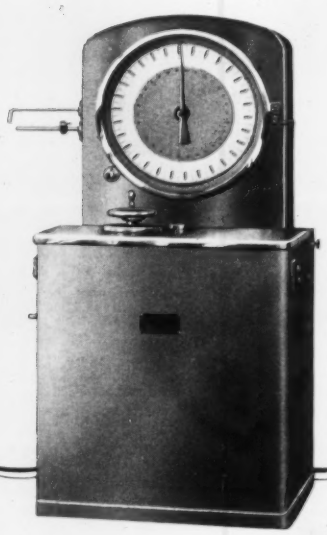

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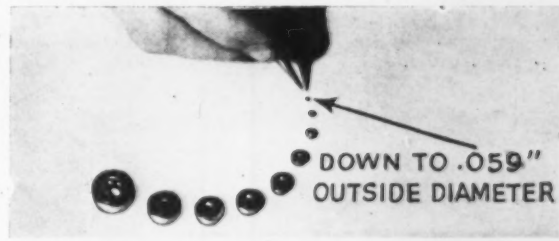

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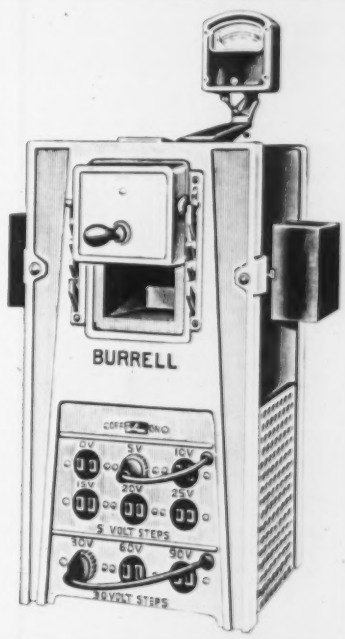

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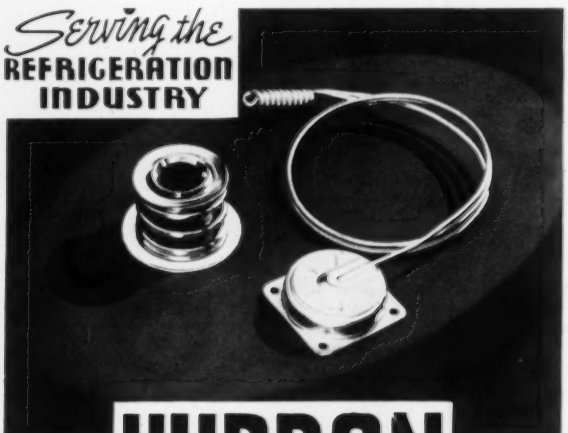

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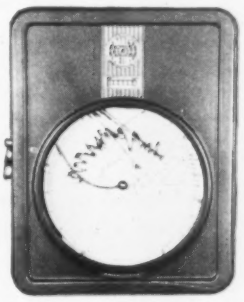

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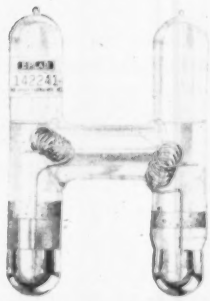

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Clough-Brengle Co.
Electronic Design Corp.
General Elec. Co.
General Radio Co.
Jackson Electrical Inst.
Leeds & Northrup Co.
RCA Mfg. Co., Inc.
Rubicon Co.
Sickles Co.

CAPACITORS, Air
Andrew, Victor J.
Cambridge Inst. Co.
Cardwell Mfg. Corp.
General Radio Co.
Leeds & Northrup Co.

CAPACITORS, Electrolytic
Aerovox Corp.
Cornell Dubilier
Crowley & Co.
General Elec. Co.
Magnavox Co.
Potter Co.
Tobe Deutschmann Corp.

CAPACITORS, Mica
Cambridge Inst. Co.
Cornell Dubilier
General Elec. Co.
General Radio Co.
Industrial Inst. Inc.
RCA Manufacturing Co.
Leeds & Northrup Co.
Potter Co.
Rubicon Co.
Sangamo Electric Co.
Sickles Co.
Solar Mfg. Corp.

CAPACITORS, Paper
Aerovox Corp.
Cornell Dubilier
Tobe Deutschmann Corp.

CAPACITORS, Precision
Leeds & Northrup Co.

CAPACITORS, Variable
Cambridge Inst. Co.
Cardwell Mfg. Co.
General Radio Co.
Leeds & Northrup Co.
Millen Mfg. Co.
Rubicon Co.

CAPACITY METERS
Aerovox Corp.
Andrew, Victor J.
Bernard, H. J.
Clough-Brengle Co.
Hickok Elec. Inst. Co.
Industrial Inst. Inc.
Leeds & Northrup Co.
Premier Crystal Labs.
Radio City Products Co.
RCA Manufacturing Co.
Rubicon Co.
Solar Mfg. Corp.
Weston Elec. Inst. Corp.

CARBON DIOXIDE METERS (See Gas Analyzers, Carbon Dioxide)

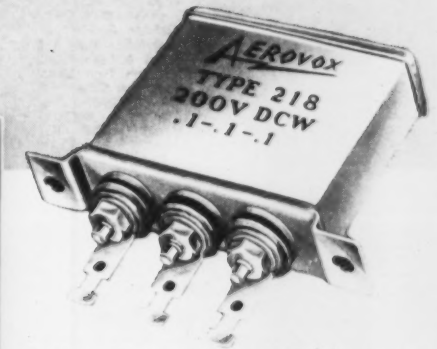
CARBON MONOXIDE METERS (See Gas Analyzers, Carbon Monoxide)

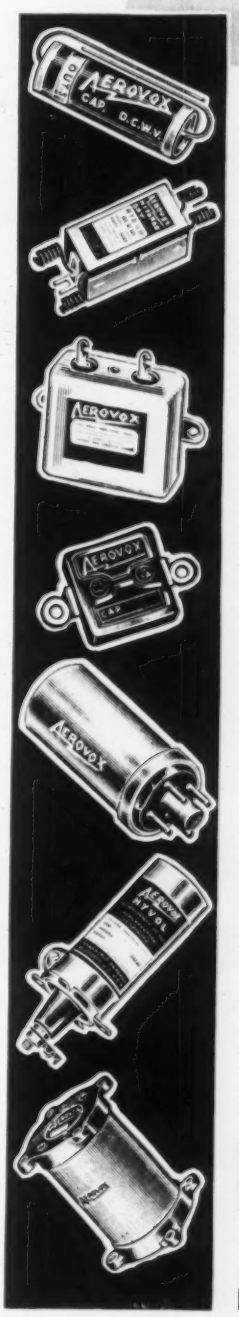
CARBON PILES (See Resistors, Carbon Compression)

CATHETOMETERS
American Askania Corp.
Cambridge Inst. Co.
Central Scientific Co.

(Continued)

CONDENSERS *truly fit for* INSTRUMENT-MAKER and USER





● Most instruments today incorporate AEROVOX condensers. First, of course, because they are dependable. But equally important is the wide choice of types and grades available. Whether it be the inexpensive servicing or shop instrument, or the costliest laboratory precision instrument, AEROVOX has the condenser that best meets the requirements of designer, maker, user.

STANDARD TYPES . . .
If economy is the prime consideration, there are the standard type Aerovox condensers. The general catalog contains every type of so-called radio condenser, carefully made yet available at mass-produced prices. These are the types serving daily in millions of radio sets, year after year, with a truly enviable record.

COMMERCIAL-GRADE . . .
If superlative performance and life are wanted, in keeping with the highest instrument standards, then Aerovox offers its so-called commercial-grade line of paper, oil, mica and electrolytic condensers identical with those heretofore made to order for the Government, commercial-communication and other critical buyers.

MADE-TO-ORDER . . .
Lastly, if your needs are entirely special, then Aerovox will work with you in developing special and exclusive types. Years of experience in condensers fitted to difficult jobs, is at your disposal.

Consult Us . . .
Submit your condenser problem for engineering collaboration, specs., quotations. Our latest literature is yours for the asking.

AEROVOX
CORPORATION
NEW BEDFORD, MASS.
IN CANADA: AEROVOX CANADA, Limited Hamilton, Ont.

For addresses, see pages 66-76

Controllers FOR AUTOMATIC REGULATION OF TEMPERATURE, COMBUSTION, pH, ETC

Micromax Electric and Pneumatic Controllers are available in models to suit any requirement. Equipment can be shipped as an assembled unit for quick, easy installation.

Metermax Combustion Control is a unit system which automatically proportions fuel and air for efficient combustion in boiler and industrial furnaces.

Send us details of any problem in control of temperature, combustion, frequency, chemical concentration, etc.

LEEDS & NORTHRUP CO.
4984 STENTON AVENUE, PHILADELPHIA

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

CATHETOMETERS
(Continued)
Ferner Co.
Fuess, Inc.
Gaertner Scientific Corp.
Mico Instrument Co.

CATHODE RAY TUBES (See Oscillographs, Cathode Ray)

CELLS, Concentration
Fish-Schurman Corp.
Leeds & Northrup Co.
Zeiss, Inc.

CELLS, Conductivity, Electrical
Allied Controls Co.
Cambridge Instrument Co.
Central Scientific Co.
Coleman Electric Co.
Fisher Scientific Co.
Fredericks, George
Gray Instrument Co.
Industrial Instruments
Leeds & Northrup Co.
Sargent & Co.
Scientific Glass App.

CELLS, Conductivity, Thermal
Cambridge Instrument Co.
Central Scientific Co.
Gow-Mac Instrument Co.
Lantz-Phelps Corp.
Leeds & Northrup Co.

CELLS, Kerr
Ratcher, Ralph R.
General Physical Lab.

CELLS, Photoelectric
Bradley Labs.
Burt Scientific Labs.
Continental Elec. Co.
De Jur-Amsco Corp.
Eby, Inc.
Electronic Lab.
Electronic Prod. Co.
Fredericks, George
General Elec. Co.
General Scientific Corp.
G-M Labs.
Hickok Elec. Inst. Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photobell Corp.
Photovolt Corp.
RCA Manufacturing Co.
Rehtron Corp.
Rhamstine, J. Thos.
United Cinephone Corp.
Vacutron, Inc.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

CELLS, Standard
Cambridge Inst. Co.
Eppley Lab.
Leeds & Northrup Co.
Rubicon Co.
Tagliabue Mfg. Co.
Thwing-Albert
Weston Elec. Inst. Corp.

CEMENT APPARATUS (See Testers & Testing Machines, Cement)

CEMENTING GAGES (See Gages, Cementing)

CEMENT MOLDS
Central Scientific Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Standard Concrete App.

CEMENT NEEDLE APPARATUS
Fisher Scientific Co.
Humboldt Mfg. Co.

CENTRIFUGES
Clay-Adams Co.
Fisher Scientific Co.
Sargent & Co.
Williams Apparatus Co.

CENTRIFUGES, Paper Testing
Williams Apparatus Co.

CENTRIFUGES, Oil Testing
Bockel & Co.
Braun Corp.
Central Scientific Co.
Eclipse Aviation
International Equip.
Moeller Inst. Co.
Precision Scientific Co.
Tagliabue Mfg. Co.
Thomas Co., Arthur H.
Western Machinery Co.
Westinghouse Elec. & Mfg.

CHAINS, SURVEYOR'S (See Surveying Instruments)

CHECKERS, RADIO TUBE (See Analyzers, Radio Set)

CHEMICAL FEEDERS, Automatic pH Control
Electronic Prod. Co.
Everson Mfg. Co.
International Filter Co.
Leeds & Northrup Co.
Syntron Company
Tagliabue Mfg. Co.
Wallace & Tiernan

CHEMICAL FEEDERS, Dry & Liquid
Builders Iron Foundry
Cochrane Corp.
Colloid Equip. Co.
Fischer & Porter
Gump Co., B. F.
International Filter Co.
Jeffrey Mfg. Co.
Mine & Smelter Sup. Co.
Omega Machine Co.
Richardson Scale Co.
Syntron Company
Wallace & Tiernan Prod.

CHEMICAL PORCELAIN (See Porcelain, Laboratory)

CHLORINE CONTROL APPARATUS (See Controllers, Automatic, Chlorine)

CHLORINE TESTING APPARATUS (See Testers, Chlorine)

CHOKES
Andrew, Victor J.
Annis Co.
Clough Brengle Co.
Martin Decker Corp.
Ohmite Mfg. Co.
Raytheon Mfg. Co.
Sickles Co.
Thordarson Elec. Co.
United Transformer Corp.

CHOKES, Precision metering, for flowtests on oilwells
Ruska & Co., Inc.

CHRONOGRAPHS
American Inst. Co.
Arisio Import Co.
Burke, Louis
Cambridge Inst. Co.
Ducommun Co.
Electro-Medical Lab.
Esterline-Angus Co.
Fecker, J. W.
Gaertner Scientific Corp.
Jaeger Watch Co.
Jardur Import Co.
Pierce Watch Co.
Precision Ther. & Inst.

CHRONOMETERS (See Watches)

CLASSIFIERS, Particle Size, Air
Colloid Equip. Co.
Federal Pneumatic Sys.

CLINOGRAPHS, Bore Hole Geophysical Inst. Co.
Sperry Sun Well Survey'g

CLINOMETERS, Ship
Kuner Co. Max
Moeller Inst. Co.

CLOCKS, Master
Cincinnati Time Rec. Co.
Gaertner Scientific Corp.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Paragon Electric Co.
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

CLOCKS, Minute Impulse & Synchronous
Cincinnati Time Rec. Co.
Cramer & Co., Inc.
Elec. Tachometer Corp.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Paragon Electric Co.
Standard Elec. Time Co.
Stromberg Electric Co.
Thomas Clock Co.
Warren Telechron Co.
Zenith Electric Co.

CLOCKS, Primary
Cincinnati Time Rec. Co.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Stromberg Electric Co.
Thomas Clock Co.

CLOCKS, Secondary
American Automatic Elec.
Cincinnati Time Rec. Co.
General Elec. Co.
Howard Clock Products
International Bus. Mach.
Standard Elec. Time
Stromberg Electric Co.
Thomas Clock Co.

CLOCKS, Standard
Gaertner Scientific Corp.
Jaeger Watch Co.
Kollsman Inst. Co.
Standard Elec. Time

CLOCKS, Stop
Central Scientific Co.
Fish-Schurman Co.
Glogau & Co.
Jaeger Watch Co.
Paragon Electric Co.
Standard Elec. Time
Tagliabue Mfg. Co.
Thompson Clock Co.
Warren Telechron Co.

CLOUD & POUR TEST APPARATUS
Ace Glass Inc.
American Inst. Co.
Central Scientific Co.
Corning Glass Works
Fisher Scientific Co.
Humboldt Mfg. Co.
Moeller Inst. Co.
Ruehtel Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Western Machinery Co.

COAL METERS
Bailey Meter Co.
Northern Equip. Co.

COIL TESTING EQUIPMENTS (See Testers, Coil)

COLLIMATORS, Vertical
Fecker, J. W.
Pioneer Instrument Co.
White Co., Inc.

COLOR ANALYZERS, Photoelectric
Akatos, Inc.
Bausch & Lomb Optical
Central Scientific Co.
Eimer & Amend
Electric Sorting Mach.
Electronic Laboratory
Electronic Prod. Co.
Ess Inst. Co.
Fisher Scientific Co.
Gaertner Scientific Corp.
General Elec. Co.
General Radio Co.
Jarrell-Ash Co.
Klett Mfg. Co.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photobell Corp.
Pho-Tron Inst. Co.
Rawson Elec. Inst. Co.
Rubicon Co.
Saxl Instrument Co.
Sheldon Electric Corp.
United Cinephone Corp.
Woermann-Schuchhardt

COLOR COMPARATORS, Photoelectric (See Color Analyzers, Photoelectric)

COLOR COMPARATORS, Visual
Akatos, Inc.
Baird Associates
Bausch & Lomb Optical
Central Scientific Co.
Electronic Research Labs.
Fischer & Porter Co.
(Cells only)
Fisher Scientific Co.
Gaertner Scientific Corp.
Hellige, Inc.
Jarrell-Ash Co.
LaMotte Chemical Prod.
Leitz, Inc.
Luxtrol Co., Inc.
Munsell Color Co.
Rascher & Betzold
Saxl Instrument Co.
Tagliabue Mfg. Co.
Taylor & Co., Inc., W. A.
United Cinephone Corp.
Zeiss, Inc., Carl

COLOR GRADERS (See Color Analyzers, Photoelectric)

COLOR MATCHING OUTFITS (See Color Comparators, Visual)

COLORIMETER TUBES (See Colorimeters, Visual)

COLORIMETERS, Photoelectric
American Inst Co.
Central Scientific Co.
Electronic Prod. Co.
Frober-Faybor Co.
General Elec. Co.
Higgins, Charles F.
Jarrell-Ash Co.
Klett Mfg. Co.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photobell Corp.
Photovolt Corp.
Pho-Tron Inst. Co.
Rubicon Co.
Saxl Instrument Co.
Scientific Glass App.
United Cinephone Corp.
Woermann-Schuchhardt

COLORIMETERS, Visual
Akatos, Inc.
American Inst. Co.
Bausch & Lomb Optical
Central Scientific Co.
Electronic Research Labs.
Fisher Scientific Co.
Jarrell-Ash Co.
Klett Mfg. Co.
Leitz, Inc.
Munsell Color Co.
Rascher & Betzold
Saxl Instrument Co.
Spencer Lens Co.
Tagliabue Mfg. Co.
Zeiss, Inc., Carl

COMBUSTION, Indicators and Recorders (See Gas Analyzers, Boiler Meters, etc.)

COMBUSTION CONTROL EQUIPMENT (See Controllers, Automatic-Combustion)

COMMUNICATION MEASURING INSTRUMENTS
American Automatic Elec.
Andrew, Victor J.
Ballantine Labs.
Bernard, H. J.
Brush Development Co.
Clough-Brengle Co.
Daven Co.
Elec. Indicator Co.
Ferris Inst. Corp.
General Elec. Co.
Hickok Elec. Inst. Co.
Industrial Inst. Inc.
Jones-Orme Co.
Leeds & Northrup Co.
Measurements Corp.
RCA Manufacturing Co.
Rubicon Co.
Sensitive Research Inst.
Shalleross Mfg. Co.
Weston Elec. Inst. Corp.

COMPARATORS, Mechanical
Farrel-Birmingham
(Gear Tooth)
Federal Prod. Corp.
Ferner Co.
Gaertner Scientific
Hathaway Inst. Co.
Mico Instrument Co.
Park Sales
Pratt & Whitney
Scherr Co., Inc.
Standard Gage
Wilder, R. S.

COMPARATORS, Optical
Applied Research Labs.
Bausch & Lomb Optical
Cambridge Inst. Co.
Electronic Research Labs.
Ess Inst. Co.
Jones & Lamson Mach.
Leitz, Inc.
Scherr Co., Inc.
Spencer Lens Co.
United Cinephone Corp.
Van Keuren Co.
Zeiss, Inc., Carl

COMPASSES, Aircraft
American Askania Corp.
Elgin Natl. Watch Co.
Kollsman Inst. Co.
Moisture Register Co.
Pioneer Instrument Co.
RCA Manufacturing Co.
Star Compass Co.

COMPASSES, Automobile
Star Compass Co.
U. S. Gauge Co.

COMPASSES, Azimuth
Ainsworth & Sons
Keuffel & Esser Co.
Leupold, Volpel & Co.
Pioneer Instrument Co.
Warren-Knight Co.

COMPASSES, Dip
Gurley, W. & L. E.
Keuffel & Esser Co.
Taylor Inst. Cos.
Warren-Knight Co.

COMPASSES, Drafting Room (See Drawing Instruments)

COMPASSES, Gyro
Sperry Gyroscope Co.

COMPASSES, Magnetic
Ainsworth & Sons
Baker Compass Co.
Geophysical Inst. Co.
Gurley, W. & L. E.
Keuffel & Esser Co.
Kollsman Inst. Co.
Leupold, Volpel & Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Star Compass Co.
Taylor Inst. Cos.
Testrite Instrument Co.
Warren-Knight Co.

COMPASSES, Marine
American Askania Corp.
Baker Compass Co.
Bendix Marine Products
Bliss & Co.
Geophysical Inst. Co.
Kuner Co., Max
Marine-Compass Co.
Negus, T. S. & J. D.
Star Compass Co.

COMPASSES, Radio
Hickok Elec. Inst. Co.
RCA Manufacturing Co.
Triumph Mfg. Co.

COMPASSES, Ship (See Compasses, Marine)

COMPASSES, Telltale (See Compasses, Marine)

COMPENSATION, Magnetic
Geophysical Inst. Co.

COMPOSING TYPEWRITERS
Coxhead Corp.

CONCENTRATION RECORDERS
Leeds & Northrup

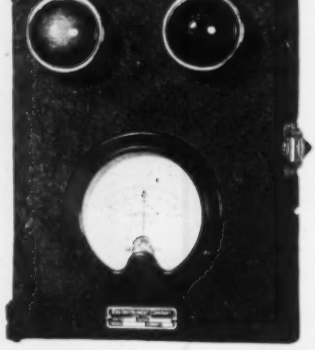
CONDENSER, Electric (See Capacitors)

CONDENSER LEAKAGE Indicators
Associated Research
Clough-Brengle Co.
Electronic Design Corp.
Hickok Elec. Inst. Co.
Industrial Inst. Inc.
Jackson Electrical Inst.
Leeds & Northrup Co.
Porter Co.
Radio City Products Co.
Rawson Elec. Inst. Co.
Tobe Deutschmann Corp.
Triumph Mfg. Co.
Weston Elec. Inst. Corp.

CONDENSER LEAKAGE Recorders
Esterline-Angus Co.
Leeds & Northrup

CONDENSER TESTERS (See Testers, Condenser)

CONDUCTIVITY METERS
Allis-Chalmers Mfg. Co.
Central Scientific Co.
Coleman Electric Co.
Electronic Prod. Co.
Esterline-Angus Co.
Industrial Inst. Inc.
(Continued)



PRECISION COMBUSTION

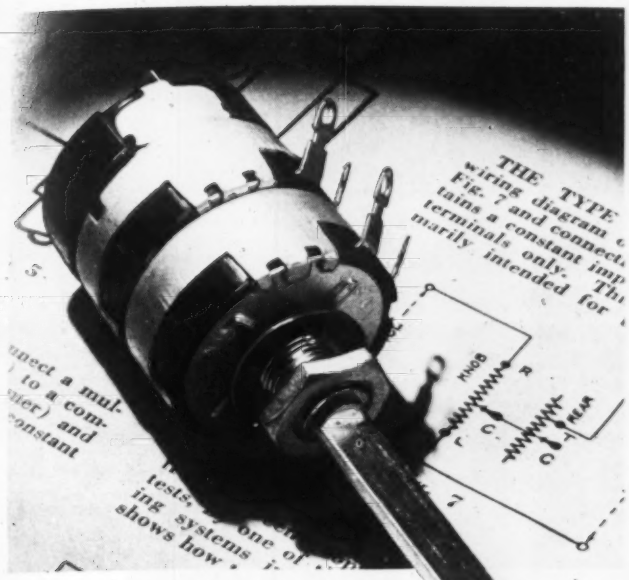
REQUIRES INSTANTANEOUS, SENSITIVE, INFORMATION

The HAZEGAGE "Electric Eye" Combustion Indicator is the *fastest* instrument on many modern panel boards. It enables automatic controls to be set *more precisely*—often on ten-second information.

It *notifies* firemen when "out of bounds"

Ess Instrument Company
30 Irving Place, N.Y.C.

For addresses, see pages 66-76



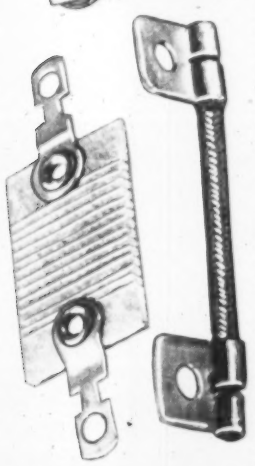
It took 20 YEARS!

★ During the past two decades, Clarostat specialists have wound *billions* of feet of resistance wire—from half the thickness of human hair, on up to the large wire sizes. They have made *millions of carbon-element controls*. They have worked closely with the most critical users of such components, including *leading instrument makers*.

Such experience is vitally important to you. More than so much bakelite or wire, metal or cement, claim or counter-claim, this backing determines the true worth of any resistor or control. So remember, 20 *long, hard, vital* years!

CONTROLS . . .

Clarostat offers the widest choice of controls in both wire-wound and composition-element types. All resistance values, tapers, taps, shafts, terminals, combinations. The recently-introduced Clarostat Power Rheostat has already won widespread acceptance in radio and aircraft equipment, because of its extraordinary electrical and mechanical ruggedness.



RESISTORS . . .

Complete line of wire-wound resistors in all types, sizes, values. Greenohm inorganic-cement-coated power resistors are now standard in better-grade instruments. Flexible resistors with cotton, silk or fibre-glass insulation, are widely employed in fine instruments. Special resistors such as three typical examples shown at left, made to order in any quantities to meet any schedule. Clarostat winding facilities are *second to none*.

BALLASTS . . .

For automatic regulation of line voltage, for voltage-dropping purposes, for bleeder networks, Clarostat offers widest range of convenient units in perforated cases and in metal-tube-type housings, with any desired bases or terminals.

Consult Us . . .

Be sure you have our loose-leaf engineering data in your working library. Yours for the asking. Meanwhile, consult us regarding any resistance or control problem. Recommendations, specifications, quotations, samples, to responsible parties.

CLAROSTAT *Manufacturing Co. Inc.*
285-287 NORTH SIXTH STREET
BROOKLYN, NEW YORK, U.S.A.
• OFFICES IN PRINCIPAL CITIES •

YOU CAN GET

NOT 1 *BUT* 5

FORMS OF CONTROL

in the New
Taylor Fulscope Controller

Industry's 5-in-1 controller for temperature, pressure, flow, liquid level

•

In this one instrument these five forms of control are available

•

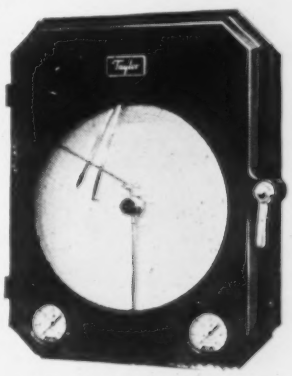
Fixed high sensitivity—for on-and-off control on applications where you have small time lags and large capacities, regardless of load changes.

•

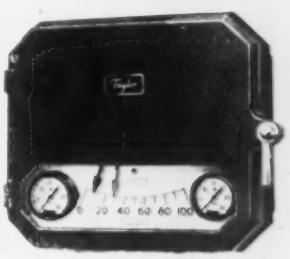
Adjustable sensitivity—for throttling control on applications with a wide range of time lags and capacities, where there are infrequent or minor load changes.

•

Adjustable sensitivity with automatic reset (in same case) for precision control on applications with a wide range of time lags and capacities, and gradual, sustained load changes.



• *The new Taylor Fulscope Recording controller. Universal case drilled and tapped to accommodate not 1 but 5 forms of process control. One or two complete control mechanisms.*



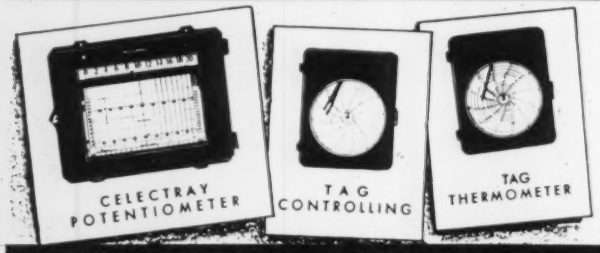
• *The new Taylor Fulscope Indicating Type. Features same as Recording Type, but controls and indicates only one variable.*

Adjustable sensitivity with Pre-Act—the extraordinary new control effect introduced by Taylor, which is based on the *rate* of control-point deviation. For applications with a wide range of time lags and capacities, and sudden, momentary disturbances *without* sustained load changes.

Adjustable sensitivity with automatic reset and Pre-Act—for ultimate precision control on complicated applications involving a wide range of time lags and capacities *with* sudden, sustained load changes.

• • •

Write for complete information and catalogs to Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.



TAG RECORDERS

These instruments are designed to record all temperatures from minus 200°C. up, and all industrial pressures. Ask for Catalogs—They graphically suggest the usefulness of TAG TEMPERATURE RECORDERS and PRESSURE RECORDERS for service and economy in your plant.

C. J. TAGLIABUE MFG. CO.
Park & Nostrand Avenues, Brooklyn, N. Y.

LOOK INSIDE the COVER (Part 1) For a COMPLETE LIST of TAG INSTRUMENTS TAG

CONDUCTIVITY METERS (Continued)
Leeds & Northrup Co.
Natl. Aluminate Corp.
Rubicon Co.
Sensitive Research Inst.
Shallcross Mfg. Co.

CONES, Pyrometric
Accurate Pyrometric Cone
Fish-Schurman Co.
Henderson & Co.
Orton Jr. Ceramic Fd'n.

CONES, Slump
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Riehle Div.

CONNECTORS, Plugs, Clips, Posts, Jacks
Am. Automatic Electric
American Inst. Co.
Autocall Co.
Clare & Co.
Eby, Inc.
General Radio Co.
Kellogg Switchboard
Meter Devices Co.
Shallcross Mfg. Co.

CONSISTENCY REGULATORS, Pulp & Paper (See Controllers, Automatic, Consistency

CONSTANT SPEED and Frequency Sets
Andrew Victor J.
Elec. Tachometer Corp.
Gaertner Scientific Corp.
General Elec. Co.
Pioneer Instrument
United Cinephone Corp.
Westinghouse Elec. & Mfg.

CONTOUR MEASURING PROJECTORS
Bausch & Lomb Optical
Leitz, Inc.
Scherr Co., Inc.

"CONTROL" —NOTE—

The following pages deserve close study. Note for example that after numerous "Controllers, Automatic" there are three classes of "Controllers, Manual." Look up also under "Regulators" for many types thus termed by usage. Also "Thermostats" and other commonly-used names of specific-purpose automatic controllers.

As a rule, Automatic Controllers are "instrument-like" while devices known as Controls (preceded by name of application) are simple, single-purpose devices.

CONTROL DRIVES (See Servo-Motors)

CONTROLS, AUTOMATIC (See Controllers, Automatic)

CONTROLLERS, AUTOMATIC (See also object of Measurement and Control)

CONTROLLERS, AUTOMATIC, Ammonia (See Ammonia Control Equipment)

CONTROLLERS, AUTOMATIC, Beater (See Controllers, Automatic, Consistency)

CONTROLLERS, AUTOMATIC, Boiler Feed
Atlas Valve Co.
Bailey Meter Co.
Consol. Ashcroft-Hancock
Fisher Governor
Foster Engg. Co.
Foxboro Co.
Henszey Co.
Kiely & Mueller
Mason-Neilan Regulator
McDonnell & Miller
Mercon Regulator Co.
Natural Gas Equipment
Northern Equip. Co.
Republic Flow Meters Co.
Robertshaw Thermostat
Ruggles-Klingemann
Watts Regulator Co.
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Boiler Water Concentration
Cochrane Corp.
Henszey Co.
Leeds & Northrup Co.
Republic Flow Meters Co.
Fischer & Porter

CONTROLLERS, AUTOMATIC, Bulk Material Level
Bin-Dicator Co.

CONTROLLERS, AUTOMATIC, Chlorine
Arca Regulators, Inc.
Askania Regulator Co.
Builders Iron Foundry
(Continued)

CONTROLLERS, AUTOMATIC, Chlorine (Continued)
Everson Mfg. Co.
LaMotte Chemical Prod.
National Meter Co.
Rascher & Betzold
Victor Equipment Co.
Wallace & Tiernan

CONTROLLERS, AUTOMATIC, Combustion
Arca Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cambridge Inst. Co.
Cash Co.
Consulting & Engineering
Denver Fire Clay Co.
General Combustion Corp.
General Regulator Corp.
Hagan Corp.
Hays Corp.
Lantz-Phelps Corp.
Leeds & Northrup Co.
Mason-Neilan Reg. Co.
Minneapolis-Honeywell
National Airoil Burner
National Brass Co.
Natural Gas Equipment
Republic Flow Meters
Selas Company

CONTROLLERS, AUTOMATIC, Condensation
Bailey Meter Co.
Boylston Co.
Fisher Governor Co.
Friez & Sons
General Regulator Corp.
Industrial Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Condenser Leakage
Leeds & Northrup Co.

CONTROLLERS, AUTOMATIC, Consistency
Brabender Corp.
Bristol Co.
D'Este Co.
Foxboro Co.
Green, Arthur B.
Mason-Neilan Regulator
Merritt Engr. & Sales
Northern Equip. Co.
Process Contros, Inc.

CONTROLLERS, AUTOMATIC, Counting
Bristol Co.
Eagle Signal Corp.
Industrial Instrument Co.
Lumenite-Electric Co.
Standard Electric Time
United Cinephone Corp.

CONTROLLERS, AUTOMATIC, Current (See Regulators)

CONTROLLERS, AUTOMATIC, Cycle
Autocall Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cramer & Co., Inc.
Denver Fire Clay Co.
Elec. Switch Corp.
Fisher Governor
Foxboro Co.
Hagan Corp.
Hanlon-Waters, Inc.
Industrial Instrument Co.
Industrial Timer Corp.
Leeds & Northrup Co.
(Continued)

CONTROLLERS, AUTOMATIC, Cycle (Continued)
Mason-Neilan Reg. Co.
Minneapolis-Honeywell
Monitor Controller Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.

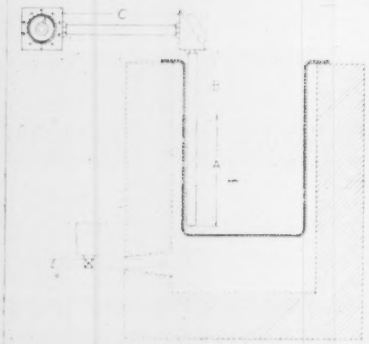
CONTROLLERS, AUTOMATIC, Damper
Arca Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber-Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Cook Electric Co.
Davis Reg. Co.
Denver Fire Clay Co.
Detroit Lubricator Co.
Electronic Prod. Co.
Fisher Governor
Foster Eng. Co.
Foxboro Corp.
Friez & Sons, Julien
Gleason-Avery, Inc.
Hagan Corp.
Hanlon-Waters, Inc.
Hays Corp.
Johnson Service Co.
Kiely & Mueller
Leeds & Northrup Co.
Mason-Neilan Regulator
Minneapolis-Honeywell
National Airoil Burner
Natural Gas Equipment
Penn Electric Switch Co.
Powers Regulator Co.
(Continued)

BURLING

HEAT CONTROLS
RAPID • ACCURATE

***NEW* Temperature Control Angle Fitting**

keeps instrument away from heat and out of the way of the work.



Cut shows model D installed in Metal Pot or Salt Bath. A turn of the outside knob changes the temperature setting instantly.

Dimension A usually 7½, 8½ or 13 in.

B and C can be varied to suit.

Temperatures — 100 to 1400 deg. F.

BURLING INSTRUMENT CO.

251-253 SPRINGFIELD AVENUE NEWARK, N. J.

COMPLETE INSTRUMENTATION

for **INDUSTRIAL PROCESSES**

CONTROLLERS for temperature, pressure, absolute pressure, rate of flow and liquid level. Air-operated potentiometer controllers. Exclusive features resulting in unexcelled performance.

RECORDERS of temperature, pressure, flow level, motion, absolute pressure.

INDICATORS of temperature, pressure, flow and level.

TRANSMISSION SYSTEMS, pneumatic type with exceptionally fast response. Electric signalling systems.

MASONEILAN

MASON-NEILAN REGULATOR CO.
1185 ADAMS ST., BOSTON, MASS., U. S. A.

For addresses, see pages 66-76

TAG CONTROLLERS

Wherever the control of plant operations presents a production problem, TAG Automatic Controllers of either the electrical or air-operated types offer competent solution. These TAG instruments have opened the way to better processing methods by more precise control of temperature, pressure and the time in which they act. Write for catalogs.

C. J. TAGLIABUE MFG. CO.
Park & Nostrand Avenues, Brooklyn, N. Y.

LOOK INSIDE the COVER (Part 1) For a COMPLETE LIST of TAG INSTRUMENTS TAG

CONTROLLERS, AUTOMATIC DAMPER (Continued)
Preferred Utilities Mfg.
Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Watts Regulator Co.
White-Rodgers Electric
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Density
Acme Regulator Co.
Arca Regulators, Inc.
Automatic Valve Control
Lamonite Electric Co.
Mine & Smelter Supply
Tagliabue Mfg. Co., C. J.
Taylor Instrument Cos.

CONTROLLERS, AUTOMATIC, Desuperheat
Arca Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Brown Inst. Co.
Foxboro Corp.
Hagan Corp.
Leeds & Northrup Co.
Mason-Neilan Regulator
Mercon Regulator Co.
Northern Equip. Co.
Republic Flow Meters Co.
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.

CONTROLLERS, AUTOMATIC, Draft
Arca Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber Coleman Co.
Boiler Room Equip.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Denver Fire Clay Co.
Foster Eng. Co.
Foxboro Co.
Friez & Sons, Julien
General Regulator Corp.
Gleason-Avery, Inc.
Hagan Corp.
Hays Corp.
Leeds & Northrup Co.
Mason-Neilan Regulator
Minneapolis-Honeywell
National Airoil Burner
National Brass Co.
Preferred Utilities Mfg.
Republic Flow Meters
Ruggles-Klingemann
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Feed Water
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Consol. Ashcroft Hancock
Fisher Governor
Hagan Corp.
(Cont'd)

CONTROLLERS, AUTOMATIC, Feed Water (Continued)
Hanlon-Waters, Inc.
Henszey Co.
Kiely & Mueller
Mason-Neilan Reg. Co.
McAlear Mfg. Co.
McDonnell & Miller
Mercon Regulator Co.
Natural Gas Equipment
Northern Equip. Co.
Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Simplex Valve & Meter
Watts Regulator Co.
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Filter Rate
Cochrane Corp.
International Filter Co.
Mason-Neilan Reg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Float
Allen-Bradley Co.
Autocall Co.
Automatic Control Co.
Automatic Temp. Control
Bailey Meter Co.
Cash Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Davis Regulator Co.
Detroit Lubricator Co.
Fisher Governor
(Cont'd)

CONTROLLERS, AUTOMATIC, Float (Continued)
Furnas Electric Co.
Foster Engg. Co.
Foxboro Co.
Frick Co.
Hagan Corp.
Hanlon-Waters, Inc.
Kiely & Mueller
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercon Regulator Co.
Penn Electric Switch
Powers Regulator Co.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Simplex Valve & Meter
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Water Level Controls Co.

CONTROLLERS, AUTOMATIC, Flow
American Meter Co.
Arca Regulators
Askania Regulator
Bailey Meter Co.
Brown Inst. Co.
Bristol Co.
Cash Co.
Denver Fire Clay Co.
Electrimatic Corp.
Fischer & Porter
Foster Engg. Co.
Foxboro Co.
General Regulator Corp.
Hagan Corp.
(Cont'd)

CONTROLLERS, AUTOMATIC, Flow (Continued)
Hanlon-Waters, Inc.
International Filter Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercon Regulator Co.
Process Controls, Inc.
Republic Flow Meters
Simplex Valve & Meter
Spence Eng. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment Co.
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Flow Proportioning
American Meter Co.
Arca Regulators, Inc.
Askania Regulator Co.
Autocall Co.
Automatic Temp. Control
Bailey Meter Co.
Barber Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Electronic Prod. Co.
Fischer & Porter
Foxboro Co.
General Regulator Corp.
(Cont'd)

CONTROLLERS, AUTOMATIC, Flow Proportioning (Continued)
Hagan Corp.
Hanlon-Waters, Inc.
Henszey Co.
Illinois Engr. Co.
International Filter Co.
Lammert & Mann Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercon Regulator Co.
Republic Flow Meters Co.
Reynolds Gas Regulator
Simplex Valve & Meter
Spence Engr. Co., Inc.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vergilio Co.
Victor Equipment Co.
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Fluid Proportioning
(See Controllers, Automatic, Flow Proportioning)

CONTROLLERS, AUTOMATIC, Frequency (See Regulators)

CONTROLLERS, AUTOMATIC, Furnace
Am. Gas Furnace Co.
Arca Regulators, Inc.
Askania Regulator Co.
Automatic Elec. Mfg. Co.
Automatic Temp. Control
Bailey Meter Co.
(Cont'd)

Bailey FEED WATER Control

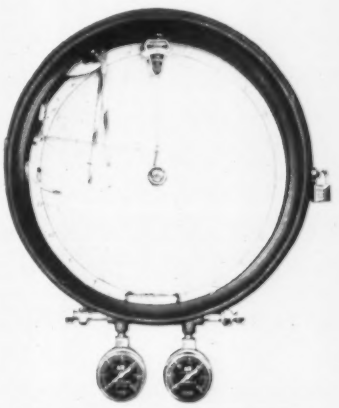
● Bailey Meter Company offers three distinct feed water control systems. They are (1) the Thermo-hydraulic Feed Water Regulator which is suitable for the majority of small boilers operating at relatively low pressures. This regulator operates from water level alone and is provided with a fully balanced tight seating V-port regulating valve designed to give a straight line characteristic. It offers the advantages of low installation cost, removable valve parts and independence of valve location.

(2) The Single-Element air-operated feed water control system is recommended for installations on which smooth regulation of feed water flow is desired, and a wide regulating range cannot be used. This system is controlled by water level alone as measured by a Bailey Boiler Drum Water Level Recorder.

(3) Bailey Three-Element feed water control is recommended for high capacity low water storage boilers operating at high pressures or for boilers operating at medium pressures with violent load fluctuations. This system is based on actual measurement of water flow to the boiler, steam flow from the boiler and water level within the boiler, and is adjusted primarily to control the rate of water flow to the boiler so that it equals the rate of steam flow from the boiler.

For detailed information consult Sweet's Engineering Catalogs or request bulletin ● No. 183.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada



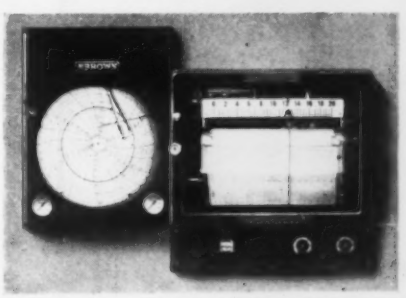
FOXBORO

Reg. U. S. Pat. Off.

Automatic Controllers

Foxboro makes a comprehensive line of Air- and Electric-Operated Controllers for temperature, pressure, flow, liquid level and humidity. The control systems include every type from the simple Open-and-Shut Control to the Foxboro Stabiloq Control System providing the ideal type of control for every job.

For information concerning the entire line of Foxboro Instruments and Controllers refer to "Sweet's Catalog," or write for a copy of Bulletin No. 199-2. **The Foxboro Company, 46 Neponset Ave., Foxboro, Mass., U.S.A.** Branch offices in 25 principal cities.



BROWN CONTROLLERS

Electric or Air-Operated Types

Brown instruments are supplied as electric or air-operated controllers, complete with valves, motor mechanisms and relays, for automatically controlling temperatures, pressures, flows, liquid levels, humidity, etc. Instruments indicate or record while they control power plant or industrial processes. Write for Catalog 89-10.

Brown Pneumatic Remote Transmission System

For remote transmission of measurement and control of temperatures, pressures, flows and liquid levels in hazardous atmospheres. Write for Bulletin 9400.

THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*
4482 Wayne Avenue, Philadelphia, Pa.

BROWN INSTRUMENTS
AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS
To Measure and Control is to Economize

For addresses, see pages 66-76

BAILEY METER *Combustion* CONTROL

● Bailey Meter Automatic Combustion Control of boilers results in substantial saving in fuel; increased boiler capacity; reduction of boiler and furnace maintenance; more time for operators to devote to general station maintenance; and improvement in the general character of service.

Bailey Meter Control makes possible the everyday operation of boilers at test efficiencies because it is a complete combustion control system which (1) automatically maintains steam pressure by supplying fuel and air simultaneously to boilers in accordance with changes in steam demand, (2) automatically maintains most economical fuel-air ratio by incorporating the Bailey Boiler Meter as an integral part of the system, (3) automatically maintains the desired furnace draft, and (4) automatically distributes load among boilers so that each unit carries its share.

This sturdy inexpensive air-operated control system has been applied to all sizes and types of boilers ranging from 200 h.p. upward. It is applicable to all fuels and all methods of firing.

For further information consult Sweet's Engineering Catalogs or write for bulletin No. 102-A.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

CONTROLLERS, AUTOMATIC, Furnace (Continued)
Barber-Coleman Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Cook Electric Co.
Defender Automatic Reg.
Denver Fire Clay Co.
Detroit Lubricator Co.
Dickson Co.
Friez & Sons
Fulton Sylphon Co.
General Regulator Corp.
Gleason-Avery, Inc.
Hagan Corp.
Hays Corp.
Industrial Engr. Corp.
Johnston Mfg. Co.
Leeds & Northrup
Lindberg Eng. Co.
Marsh Corp.
Mason-Neilan Regulator
McCorkle Co.
Minneapolis-Honeywell
National Airoil Burner
National Brass Co.
Natural Gas Equipment
Paragon Electric Co.
Parlow Corp.
Payne Furnace & Supply
Penn Electric Switch
Perfex Corp.
Pyrometer Inst. Co.
Republic Flow Meters
Ruggles-Klingemann
Spence Engineering Co.
Spencer Thermostat Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Cinephone Corp.
Wheelco Inst. Co.
White Mfg. Co.
White-Rodgers Electric
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Gas Density
Refinery Supply Co.

CONTROLLERS, AUTOMATIC, Gas Mixing (See Controllers, Automatic, Flow Proportioning)

CONTROLLERS, AUTOMATIC, Granular Material Level
Bin-Dicator Co.

CONTROLLERS, AUTOMATIC, Gravity
Arca Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
Binckley G. S.
Foxboro Co.
Mason-Neilan Regulator
Mine & Smelter Supply
Tagliabue Mfg. Co.
Taylor Inst. Cos.

CONTROLLERS, AUTOMATIC, Humidity
American Moistening Co.
Arca Regulators, Inc.
Atlas Valve Co.
Barber-Coleman Co.
Brabender Corp.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft-Hancock
Cramer & Co., Inc.
Detroit Lubricator Co.
Dietert Co.
Electronic Prod. Co.
Fenwal, Inc.
Foxboro Co.
Friez & Sons
General Controls Co.
H-B Inst. Co., Inc.
Industrial Inst. Co.
Johnson Service Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
McDonnell & Miller
Minneapolis-Honeywell
Moeller Instrument Co.
Moisture Register Co.
Parks-Cramer Co.
Penn Electric Switch
(Continued)

CONTROLLERS, AUTOMATIC, Humidity (Continued)
Phila. Thermometer Co.
Powers Regulator Co.
Robertshaw Thermostat
Sarco Co., Inc.
Scientific Inst. Co.
Superior Elec. Prods.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Tweng-Albert Inst. Co.
Trerice Co., H. O.
Vaughn-G. E. Wirt Co.
Weksler Thermometer

CONTROLLERS, AUTOMATIC, Humidity and Temperature (See Controllers, Automatic, Humidity and Controllers, Automatic, Temperature)

CONTROLLERS, AUTOMATIC, Lighting
Betts & Betts
Cutler-Hammer, Inc.
Luxtrol Co., Inc.
Paragon Electric Co.
United Cinephone Corp.
Weston Elec. Inst. Corp.
Zenith Electric Co.

CONTROLLERS, AUTOMATIC, Liquid Level
Allen-Bradley Co.
American Meter Co.
Arca Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Autocall Co.
Bailey Meter Co.
Belfield Co.
Binckley G. S.
Bin-Dicator Co.
Boylston Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Cochrane Corp.
Consol. Ashcroft-Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
Electronic Prod. Co.
D'Este Co.
Elec. Indicator Co.
Fisher Governor Co.
Foster Engg. Co.
Foxboro Co.
Frick Co.
Furnas Electric Co.
General Controls Co.
General Regulator Corp.
Guardian Elec. Mt. Co.
Hagan Corp.
Hanlon-Waters, Inc.
International Flow Co.
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Mercoid Corp.
Mercon Regulator Co.
Minneapolis-Honeywell
National Airoil Burner
Natural Gas Equipment
Northern Equip. Co.
Paragon Electric Co.
Pioneer Instrument
Powers Regulators Co.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Process Controls, Inc.
Republic Flow Meters
Schade Valve Mfg. Co.
Simplex Valve & Meter
Spence Engineering Co.
Stets Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.
Water Levels Controls Co.
(Cont'd)

CONTROLLERS, AUTOMATIC, Liquid Level (Continued)
Watts Regulator Co.
Wheelco Inst. Co.
Wilcus Mfg. Co.

CONTROLLERS, AUTOMATIC, Load (See Regulators)

CONTROLLERS, AUTOMATIC, Moisture (See Controllers, Automatic, Humidity)

CONTROLLERS, AUTOMATIC, Phase (See Regulators)

CONTROLLERS, AUTOMATIC, Power Factor (See Regulators)

CONTROLLERS, AUTOMATIC, Pressure & Vacuum
Acme Regulator Co.
Allen-Bradley Co.
American Meter Co.
Arca Regulators, Inc.
Askania Regulator Co.
Arca Regulators, Inc.
Atlas Valve Co.
Autocall Co.
Automatic Control Co.
Automatic Temp. Control
Bailey Meter Co.
Baldwin-Southwark Corp.
Bastian-Blessing Co.
Belfield Co.
Bockel & Co.
Boylston Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Connelly Iron Sponge Co.
Consol. Ashcroft-Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
Dickson Co.
Eclipse Fuel Engg.
Emerson Apparatus Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Foxboro Co.
Fredericks, George
Friez & Sons
Fulton Sylphon Co.
Furnas Electric Co.
Gas Appl. Specialties
General Controls Co.
General Electric Co.
General Regulator Corp.
Gen. Sales & Prod.
Hagan Corp.
Hanlon-Waters, Inc.
Hays Corp.
Hoke, Inc.
Hydraulic Press Co.
Illinois Engg. Co.
Industrial Inst. Co.
Klipfel Mfg. Co.
Lammert & Mann Co.
Leeds & Northrup Co.
Leslie Co.
Marsh Corp.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Mercoid Corp.
Mercon Regulator Co.
Minneapolis-Honeywell
Natural Gas Equip. Inc.
Northern Equip. Co.
Penn Electric Switch
Perfex Corp.
Powers Regulator Co.
Precision Therm. & Inst.
Ranco Inc.
Republic Flow Meters
Reynolds Gas Regulator
Robertshaw Thermostat
(Cont'd)

"Radio Principle" Temperature Controllers

Wheelco offers a complete line of Temperature Controllers, employing the famous "Radio Principle" Control System.
"Radio Principle" Controllers include:

CAPACITROLS
Pyrometer Controllers

POTENTIOTROLS
Potentiometer Controllers

THERM-OTROLS—Indicating or Recording Thermometer Controllers

LIMITROLS—Automatic Shut-off Controllers

PROGRAM CONTROLS—PROPORTIONING CONTROLLERS, RESISTANCE THERMOMETER CONTROLLERS

Complete data are available on all the above Controllers. Write for your copies, today.

Wheelco Instruments Co.
1929-33 S. HALSTED STREET · · · CHICAGO, ILLINOIS

Taylor

Self-Acting Temperature Controllers

Write for complete information and catalogs.

Taylor Instrument Companies
ROCHESTER, N.Y. TORONTO, CANADA

Taylor

Liquid Level Indicators, Recorders, Controllers

Write for complete information and catalogs.

Taylor Instrument Companies
ROCHESTER, N.Y. TORONTO, CANADA

STANDARD & SPECIAL
CONTROLS

To Increase and Improve Production

CONTROLS IN STOCK FOR OUR DEFENSE FORCES

Manufacturers of . . . .

Air and hydraulically, PILOT operated, CONTROLS of WIDE RANGE

FOR

PRESSURE	TEMPERATURE	SPEED
VACUUM	HUMIDITY	LEVEL
FLOW	CONSISTENCY	COMBUSTION

SPECIAL APPLICATIONS

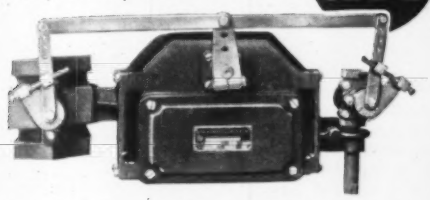
Sensitivity to Within 1%, Fully Compensated

ARCA REGULATORS, INC.

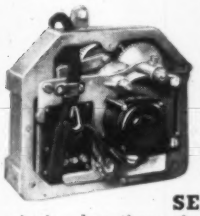
ESTABLISHED 1927 UPPER MONTCLAIR, N. J.

MOTOR-OPERATED CONTROLLERS ...by atc

For automatic control of Temperature, Level, Pressure, Flow



ATC manufactures the broadest line of valve-control mechanisms, standard types ranging from the simplest "off-on" control to fully balancing of the medium against the demand at any moment. Thousands now in use are demonstrating their accuracy, ruggedness and dependability. All models are easily installed from instructions accompanying shipments. Illustrated is the ATC RELATROL which provides compensating valve positions in direct relation to deviation from the control setting. To show sturdiness and simplicity two views are shown; the upper a front view with two valves, the lower a back view with heavy protective cover removed. Ask about ATC before specifying any valve-control devices.



SEND for BULLETIN G-10
which describes the various standard units
Representatives in Principal Cities

AUTOMATIC TEMPERATURE CONTROL CO.
25 E. Logan St. Philadelphia, Pa.

CONTROLLERS, AUTOMATIC, Pressure and Vacuum (Cont'd)
Ruggles-Klingemann
Schade Valve Mfg. Co.
Schwien Eng. Co.
Scientific Inst. Co.
Spence Engineering Co.
Spencer Thermostat Co.
Sterling Eng. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co., H. O.
Uehling Instrument Co.
Vapor Recovery Systems
Vaughn-G. E. Witt Co.
Victor Equipment Co.
Ward Leonard Elec. Co.
Water Level Controls Co.
Watts Regulator Co.
Wheelco Inst. Co.
White-Rodgers Electric
Wilgus Mfg. Co.

CONTROLLERS, AUTOMATIC, Pyrometric
Am. Gas Furnace Co.
Askania Regulator Co.
Automatic Temp. Control
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Dickson Co.
Electronic Lab.
Electronic Prod. Co.
Engelhard, Chas.
Ferner Co.
Foxboro Co.
General Elec. Co.
G-M Labs
Hoskins Mfg. Co.
Ill. Testing Labs.
Industrial Instrument Co.
Leeds & Northrup Co.
Lewis Engg. Co.
Lindberg Eng. Co.
Mason-Neilan Regulator
Partlow Corp.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Uehling Instrument Co.
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Radio Remote
Am. Automatic Electric
Guardian Elec. Mfg. Co.
RCA Manufacturing Co.
United Cinephone Corp.

CONTROLLERS, AUTOMATIC, Rate-Volume (See Controllers, Automatic, Flow)

CONTROLLERS, AUTOMATIC, Refrigeration
Allen-Bradley Co.
Brown Inst. Co.
Cash Co.
Cutler-Hammer, Inc.
D'Este Co.
Detroit Lubricator Co.
Dickson Co.
Electrimatic Corp.
Frick Co.
Friez & Sons, Julien
Fulton Sylphon Co.
General Controls Co.
Illinois Engr. Co.
Lumenite Elec. Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercoid Corp.
Minneapolis-Honeywell
Penn Electric Switch
Perfex Corp.
Phila. Thermometer Co.
Ranco, Inc.
Sarco Co., Inc.
Schade Valve Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
White-Rodgers Electric

CONTROLLERS, AUTOMATIC, RKVA (See Regulators)

CONTROLLERS, AUTOMATIC, Specific Gravity (See Controllers, Automatic, Gravity)

CONTROLLERS, AUTOMATIC, Speed (See Tachometric below)

CONTROLLERS, AUTOMATIC, Stoker (See Controllers, Automatic, Furnace)

CONTROLLERS, AUTOMATIC, Strain-Rate & Stress-Rate
Baldwin-Southwark Corp.

CONTROLLERS, AUTOMATIC, Synchronizing (See Regulators)

CONTROLLERS, AUTOMATIC, Tachrometric
Askania Regulator Co.
Bailey Meter Co.
Barbour Stockwell Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Foxboro Co.
General Regulator Corp.
Hagan Corp.
Mason-Neilan Regulator
Moisture Register Co.
Monitor Controller Co.
Republic Flow Meters

CONTROLLERS, AUTOMATIC, Temperature (See Pyrometric above or Thermometric below)

CONTROLLERS, AUTOMATIC, Temperature-Time (See Controllers, Automatic Thermometric; Controllers, Automatic, Thermostatic; Controllers, Automatic, Time)

CONTROLLERS, AUTOMATIC, Thermometric
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Consol. Asheroft-Hancock
Dickson Co.
Edison Electrical Controls
Electrimatic Corp.
Electro-Medical Lab.
Emerson Apparatus Co.
Fish-Schurman Co.
Foxboro Co.
Friez & Sons
General Elec. Co.
General Regulator Corp.
Gotham Inst. Co.
H-B Inst. Co., Inc.
Ill. Testing Labs.
Kessler Co.
Lindberg Eng. Co.
Marsh Corp.
McAlear Mfg. Co.
Minneapolis-Honeywell
Moeller Instrument Co.
Moisture Register Co.
Paragon Electric Co.
Parks-Cramer Co.
Partlow Corp.
Precision Therm. & Inst.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
Weksler Thermometer
Wheelco Inst. Co.

CONTROLLERS, AUTOMATIC, Thermostatic
Accuracy Scientific Inst.
Allen-Bradley Co.
American Inst. Co.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Barber-Coleman Co.
Boekel & Co.
Bristol Co.
Boiler Room Equip.
Brown Inst. Co.
Burling Inst. Co.
Bushnell & Nevins
Cook Electric Co.
Cramer & Co., Inc.
(Cont'd)

TYPE 4357T controller with Type 4300 Wizard Pilot mounted integral with topwork. Note greater compactness of pilot assembly.

FOR ACCURATE PRESSURE CONTROL

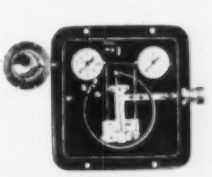
Use

FISHER WIZARD PILOT REGULATORS

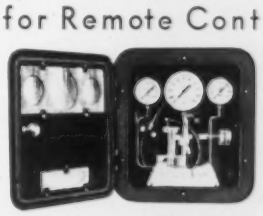
with throttling range adjustment

1. Throttling Range Adjustment —1% to 75% of Tube Range.
2. Vernier hand adjustment mechanism for pressure setting.
3. Larger and more sensitive Bourdon Tube.
4. Weather-proof integral gauge housings.
5. Gas-tight and weather-proof cases.
6. High pressure control connections and leads.
7. Easily changed from reverse to direct acting or vice-versa—without changing tube position.

Wizard Pilot Valves for Remote Control



Surface Mounting Type 4100S Pilot with cover removed.

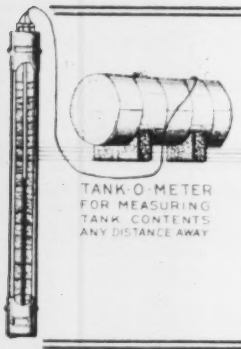


Flush Mounting Type 4100F Pilot with cover open.

DIAPHRAGM MOTOR VALVES
LIQUID LEVEL CONTROLLERS

FISHER GOVERNOR COMPANY
1301 Fisher Bldg., Marshalltown, Iowa

For addresses, see pages 66-76



UEHLING INSTRUMENT CO.

Vacuum-Draft-CO_2

Absolute Pressure Recorders - Liquid Level Gauges

473 GETTY AVENUE

PATERSON, N.J.

CONTROLLERS, AUTOMATIC Time (Cont'd)
D'Este Co.
Detroit Lubricator Co.
Dickson Co.
Edison Electrical Control
Ernstat Co.
Fenwal, Inc.
Fish-Schurman Co.
Friez & Sons
Foster Eng. Co.
Fulton Sylphon Co.
General Controls Co.
General Elec. Co.
Gleason-Avery, Inc.
Gotham Inst. Co.
H-B Inst. Co.
H. & H. Thermostats
Illinois Lngr. Co.
Industrial Engr. Corp.
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Marsh Corp.
McCorkle Co.
Merceol Corp.
Minneapolis-Honeywell
Moisture Register Co.
Partlow Corp.
Penn Electric Switch
Peerless Corp.
Phila. Thermometer Co.
Powers Regulator Co.
Precision Therm. & Inst.
Ranco Inc.
Rascher & Betzold
Robertshaw Thermostat
Ruggles-Klingemann
Saren Co., Inc.
Spence Engineering Co.
Spencer Thermostat Co.
Sterling Eng. Co.
Struthers-Dunn
Tagliabue—Mfg. Co.
Trane Co.
Vaughn G. E. Witt Co.
Weston Elec. Inst. Corp.
White Mfg. Co.
White-Rodgers Elec. Co.

CONTROLLERS, AUTOMATIC, Time
Allen-Bradley Co.
Am. Gas Accumulator
Automatic Elec. Mfg. Co.
Automatic Temp. Control
Bailey Meter Co.
Betts & Betts
Bristol Co.
Consol. Ashcroft-Hancock
Cramer & Co., Inc.
Eagle Signal Corp.
Edison Electrical Prods.
Elec. Switch Corp.
Foxboro Co.
Friez & Sons, Julien
General Elec. Co.
Gotham Inst. Co.
Hanlon-Waters, Inc.
Industrial Timer Corp.
Industrial Instrument Co.
Johnson Service Co.
(Cont'd)

CONTROLLERS, AUTOMATIC Thermostatic (Continued)
Luxtrol Co., Inc.
Magnetic Gauge Co.
Mason-Neilan Regulator
Minneapolis-Honeywell
Monitor Controller Co.
Paragon Electric Co.
Penn Electric Switch
Powers Regulator Co.
Stromberg Electric Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thomas Clock Co., Seth
United Cinephone Corp.
Warren Telechron Co.
Zenith Electric Co.

CONTROLLERS, AUTOMATIC, Vacuum (See Controllers, Automatic, Pressure)

CONTROLLERS, AUTOMATIC, Valve (See Valve-Operating Devices)

CONTROLLERS, AUTOMATIC, Viscosity
Brabender Corp.
Bailey Meter Co.
General Elec. Co.
Green, Arthur R.
Scientific Inst. Co.
United Cinephone Corp.

CONTROLLERS, AUTOMATIC, Voltage (See Regulators)

CONTROLLERS, AUTOMATIC, Volume (See Controllers, Automatic, Flow)

CONTROLLERS, MANUAL (Non-automatic), Field
Cutler-Hammer, Inc.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Schaefer Bros. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROLLERS, MANUAL (Non-automatic) Motor
Allen-Bradley Co.
Cutler-Hammer, Inc.
Elec. Controller & Mfg.
Furnas Electric Co.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Schaefer Bros. Co.
Superior Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROLLERS, MANUAL (Non-automatic) Rheostatic
Allen-Bradley Co.
Allis-Chalmers Mfg. Co.
(Cont'd)

CONTROLLERS, MANUAL (Non-Automatic) Rheostatic (Cont'd)
Beck Bros.
Cutler-Hammer, Inc.
Elec. Controller & Mfg.
General Elec. Co.
Monitor Controller Co.
National Elec. Controller
Ohmite Mfg. Co.
Rubicon Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

CONTROL SYSTEMS (See Controllers, Automatic)

COUNTERS, Alarm
Durant Mfg. Co.

COUNTERS, Colony
Fisher Scientific Co.
Sargent & Co.
Spencer Lens Co.
Thomas Co., Arthur H.

COUNTERS, Cycle
Bristol Co.
General Elec. Co.
Industrial Inst. Co.
Moisture Register Co.
Paragon Electric Co.
Raytheon Mfg. Co.
Southwestern Electronics
Standard Elec. Time Co.
States Co.
United Cinephone Corp.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

COUNTERS, Footage
Adde & Co.
Bristol Co.
Durant Mfg. Co.
Elec. Tachometer Corp.
McDonnell Odometer Co.

COUNTERS, Footage (Cont'd)
Ohmer Register Co.
Saxl Inst. Co.
Southwestern Electronics
Talley-Meter Co.
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Geiger-Muller
Cambridge Instrument Co.
Geophysical Instrument
Vacutron, Inc.
Welch Scientific Co.

COUNTERS, Hour
Cramer & Co., Inc.
Elec. Tachometer Corp.
General Elec. Co.
Ohmer Register Co.
Paragon Electric Co.
Southwestern Electronics
United Cinephone Corp.
Warren Telechron Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

COUNTERS, Lumber
Adde & Co.
Durant Mfg. Co.
Keuffel & Esser Co.
McDonnell Odometer Co.
Moisture Register Co.
Tally-Meter Co.

COUNTERS, Photoelectric
Ess Instrument Co.
Lumenite Electric Co.
Paver-Stills Co.
Photobell Corp.
Production Instrument
Vacutron, Inc.
United Cinephone Corp.
Weston Electrical Inst.

COUNTERS, Production
Adde & Co.
Bristol Co.
Cramer & Co., Inc.
Durant Mfg. Co.
Elec. Tachometer Corp.
Guardian Elec. Mfg. Co.
Hart Mfg. Co., R. E.
Luxtrol Co., Inc.
McDonnell Odometer Co.
Moisture Register Co.
Ohmer Register Co.
Photobell Corp.
Production Inst. Co.
Richardson Scale Co.
Struthers-Dunn
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Revolution
Adde & Co.
Bristol Co.
Boulin Instrument Corp.
Cumming Machine Wks.
Durant Mfg. Co.
Elec. Tachometer Corp.
Gurley, W. & L. E.
Hart Mfg. Co., R. E.
Ideal Commutator Dresser
(Cont'd)

COUNTERS, Revolution (Continued)
Jaeger Watch Co.
Jones-Motrola Sales Co.
Knopf, Paul
Luxtrol Co., Inc.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
McDonnell Odometer Co.
McNab of Bridgeport
Moisture Register Co.
Ohmer Register Co.
Production Inst. Co.
George Scherr Co., Inc.
Southwestern Electronics
Speidel & Co.
Standard Elec. Time Co.
Star Brass Mfg. Co.
Starrett Co., L. S.
Veeder-Root, Inc.
Warren Knight Co.
Zetnickow Co., O.

COUNTERS, Stroke
Adde & Co.
Bristol Co.
Durant Mfg. Co.
Eagle Signal Corp.
Guardian Elec. Mfg. Co.
Hart Mfg. Co., R. E.
International Register Co.
Luxtrol Co., Inc.
McDonnell Odometer Co.
Moisture Register Co.
Photobell Corp.
Ohmer Register Co.
Production Inst. Co.
Southwestern Electronics
United Cinephone Corp.
Veeder-Root, Inc.

COUNTERS, Twist
Luxtrol Co., Inc.
McDonnell Odometer Co.
Roller-Smith Co.
Saxl Instrument Co.
Scott Co., Henry L.
Southwestern Electronics
Suter, Alfred
Veeder-Root, Inc.

COURSE PROTRACTORS (See Protractors, Course)

CRYSTALS, Piezoelectric
Bausch & Lomb Opt.
Bliley Electric Co.
Brush Development Co.
General Radio Co.
Premier Crystal Labs.
RCA Manufacturing Co.
Valpey Crystals
Zeiss, Inc., Carl

CRYSTALS, Quartz
Bliley Electric Co.
Fuess, Inc.
General Radio Co.
Master Optical Co.
Premier Crystal Labs.
RCA Manufacturing Co.
Valpey Crystals

CRYSTALS, Rochelle Salt
Brush Development Co.

CRYSTALS, Tourmaline
Fuess, Inc.
Premier Crystal Labs.
Zeiss, Inc., Carl

CUBIC FOOT BOTTLES (See Bottles, Cubic Feet)

CURRENT LIMITERS
Betts & Betts
General Elec. Co.
Monitor Controller Co.

CURRENT METERS (See Meters, Current)

CURRENT REGULATORS (See Regulators, Current)

CURVE TRACERS (See Drawing Instruments)

CUTMETERS
Amthor Testing Inst. Co.
Coats Mach. Tool Co.
McDonnell Odometer Co.
Veeder-Root, Inc.

CYCLE CONTROLLERS (See Controllers, Automatic, Cycle)

CYCLE COUNTERS (See Counters, Cycle)

CYCLOMETERS
Veeder-Root, Inc.

CYLINDERS, GRADUATED (See Apparatus Laboratory, Glass)

DECELEROMETERS (See Accelerometers)

DECIBEL METERS (See Sound Level Meters)

DEEP SEA INSTRUMENTS
Ballauf Mfg. Co.
Moeller Inst. Co.

DEFLECTION TESTERS, Light Wave (See Testers, Deflection, Light Wave)

DEFORMETERS
Baldwin-Southwark Corp.
Dietert Co.

DELINEASCOPES
Bausch & Lomb
Central Scientific Co.
Leitz, Inc.
Spencer Lens Co.

DEMAND, Indicators (See Meters, Demand, Electric: Meters, Demand, Gas)

DEMAND, Recorders (See Meters, Demand)

DEMAND — LIMITING METERS (See Meters, Demand Limiting)

DEMAND METERS (See Meters, Demand)

DEMAND TOTALIZING RELAYS & DEVICES (See Relays, Demand Totalizing)

Taylor

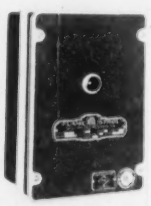
Flow Indicators, Recorders, Controllers, etc.

Write for complete information and catalogs.

Taylor Instrument Companies

ROCHESTER, N.Y. TORONTO, CANADA

Wheelco Flame-otrols Combustion Safeguards



Wheelco Flame-otrols provide positive safety against combustion explosions resulting from flame failure. Flame-otrols also prevent entry of fuel into the combustion chamber until adequate means are provided for establishing ignition. The Flame-otrol is the only combustion safeguard approved by both Underwriters' Laboratories and Associated Factory Mutual Laboratories for all types of fuel.

Complete description given in Bulletin No. 12-2. Write for your copy, today.

Wheelco Instruments Co.

1929-33 S. HALSTED STREET · · · CHICAGO, ILLINOIS

Taylor

Type "P" Expansion Stem Temperature Controllers

Write for complete information and catalogs.

Taylor Instrument Companies

ROCHESTER, N.Y. TORONTO, CANADA

For addresses, see pages 66-76

DENSIMETERS
Kett Luminare Corp.
Pfaltz & Bauer, Inc.
Tagliabue Mfg. Co.

DENSITOMETERS
Applied Research Labs.
Baird Associates
Bausch & Lomb Opt.

DENSOMETERS
Keatos, Inc.
Gaertner Scientific Corp.
Gurley, W. & L. E.
Zeiss, Inc., Carl

DEPTH, Indicators, Length
Chicago Dial Ind. Co.
Federal Prod. Corp.
Gen. Engg. & Model Wks.
Starrett Co.

DEPTH, Indicators, Liquid (See Gages, Liquid Level, Indicating)

DEPTH INDICATORS, Sea
Moeller Inst. Co.

DEPTH, Recorders, Liquid (See Gages, Liquid Level, Indicating)

DETECTOR CARS, For Testing Rails in Track
Sperry Products, Inc.

DETECTORS, Benzol
Mine Safety Appliances

DETECTORS, Carbon Monoxide
Mine Safety Appliances

DETECTORS, Hydrogen Cyanide
Mine Safety Appliances

DETECTORS, Hydrogen Sulphide
Mine Safety Appliances

DETECTORS, Mercury Vapor
Mine Safety Appliances

DETECTORS, Metal
Associated Research
General Elec. Co.
Geophysical Inst. Co.
Ill. Testing Labs.
Luxtrol Co., Inc.
McFarlin Co.
RCA Manufacturing Co.
United Cinephone Corp.

DETECTORS, Methane
Mine Safety Appliances

DETECTORS, Mine Gases
Bushnell & Nevins
Mine Safety Appliances

DETECTORS, Potential
Littelfuse Labs.
Mercallac Electric Co.

DETECTORS, Radium
American Inst. Co.

DETECTORS, Voltage
General Elec. Co.
Gen. Physical Laboratory
Ideal Commutator Dresser
Meter Devices Co.
Mercallac Electric Co.

DIAL INDICATORS (Length)
Ames Co., B. C.
Brown & Sharpe
Chicago Dial Ind. Co.
Federal Prod. Corp.
Gen. Engg. & Model Wks.
Premier Crystal Labs.
Scherr Co., Geo.
Scientific Inst. Co.
Starrett Co.

DIAL MICROMETERS (See Micrometers, Dial)

DIFFERENTIAL PRESSURE (See Controllers, Gages, etc., Pressure)

DIFFRACTION GRATING (See Grating, Diffraction)

DILATOMETERS
American Inst. Co.
Dietert Co.
Ferner Co.
Gaertner Scientific Corp.
E. Leitz, Inc.
Rockwell Co., Stanley P.
Zeiss, Inc., Carl

DIVIDERS, Voltage (Radio Frequency)
Andrew, Victor J.
Beck Bros.
Ferris Inst. Corp.
General Elec. Co.
General Radio Co.
Instrument Resistors, Inc.
International Resistance Measurements Corp.
Muter Company
Ohmite Mfg. Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Televiso Co.
Ward Leonard Elec. Co.

DIVIDING HEAD, OPTICAL
Zeiss, Inc., Carl

DIVIDING MACHINES
American Askania Corp.
Brown & Sharpe
Gaertner Scientific Corp.
Hayes Scientific Apps.
Mico Instrument Co.
Precise Instrument Co.

DRAFT Indicators (See Gages, Draft) Recorders (See Gages, Draft)

DRAFT Controllers (See Controllers, Automatic Draft)

DRAWING INSTRUMENTS
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Altendorf & Sons
Dietzgen Co.
Drafto Co.
Gurley, W. & L. E.
Henschel & Co.
Kern Co.
Keuffel & Esser Co.
Millers Falls Co.
Nelson Section Liner
Post Co., Frederick
Soltmann, Inc., E. G.
Speidel & Co.
Starrett Co., L. S.
Union Tool Co.
United States Blue Print
Warren-Knight Co.
Weber Co., F.
White Co., Inc., David

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Driftmeters, Inc.
Gurley, W. & L. E.
Kollmorgen Optical Co.
Kollsman Inst. Co.
Pioneer Instrument Co.

DRIFT INDICATORS, Bore Hole
Sperry-Sun Well Surveying

DUROMETERS (See Testers & Testing Machines, Hardness)

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Bausch & Lomb Optical
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Corning Glass Works
Eimer & Amend
Falstrom Co.
Federal Pneumatic Systems
Fisher Scientific Co.
Macalaster Bicknell Co.
Mine Safety Appliances
Pfaltz & Bauer, Inc.
Sargent & Co.
Scientific Glass Apparatus
Scientific Inst. Co.
Willson Products, Inc.
Zeiss, Inc., Carl

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DYNAMOMETERS, Pull Rod
Hathaway Inst. Co.
Hayes Scientific Apps.
Martin Decker Corp.
Seederer-Kohlbusch, Inc.

DYNAMOMETERS, Rotary Absorption
Bristol Co.
General Elec. Co.
L. A. B. Corp.
Mid-West Dynamometer

DYNAMOMETERS, Tension
Baldwin-Southwark Corp.
Boulin Instrument Corp.
Dillon & Co.
Hathaway Inst. Co.
Olsen Testing Machine
Riehle Div.
Seederer-Kohlbusch
Thwing-Albert

DYNAMOMETERS, Transmission
Seederer-Kohlbusch

EARTH CURRENT METERS (See Meters, Earth Current)

EARTH RESISTANCE METERS
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Biddle Co., Jas. G.
Geophysical Inst. Co.
Industrial Insts. Inc.
Rawson Electrical Inst.
Rubicon Co.
Stucht & Co.

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Braun Corp.
Central Scientific Co.
Eimer & Amend
Precision Therm. & Inst.
Rascher & Betzold
Tagliabue Mfg. Co.

EBULLISCOPE (See Ebulliometers)

ECHELON GRATING (See Grating, Echelon)

ELECTRIC WAVE FILTER SECTIONS
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Bilby Electric Co.
Clough-Brengle Co.
General Radio Co.
United Transformer Corp.

ELECTROMETERS, Quadrant
Cambridge Inst. Co.
Central Scientific Co.
Pfaltz & Bauer, Inc.
Rubicon Co.
Esterline Instrument Co.
Welch Mfg. Co.

ELECTROMETERS, String
Cambridge Inst. Co.
Geophysical Inst. Co.
Pfaltz & Bauer, Inc.

ELECTRONIC METERS (See Meters, Electronic)

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Fisher Scientific Co.
Hellige, Inc.
Industrial Insts. Inc.
Pfaltz & Bauer, Inc.
Sargent & Co.
Taylor & Co., Inc., W. A.
Thwing-Albert Inst. Co.

ELECTROSCOPES
Chicago Apparatus Co.
Denver Fire Clay Co.
Geophysical Inst. Co.
Pfaltz & Bauer, Inc.

ELLIPSOGRAPHS (See Drawing Instruments)

END MEASURES
Pratt & Whitney

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ENGINE INDICATOR REDUCING MOTION (See Reducing Motion, Engine Indicator)

EUDIOMETERS
Ace Glass Inc.
Central Scientific Co.
Eimer & Amend
Machlett & Son

EUSCOPES
Bausch & Lomb Optical

EXPANSION TEST APPARATUS (See Testers, Expansion)

EXTENSOMETERS
American Inst. Co.
Baldwin-Southwark Corp.
Brabender Corp.
Cambridge Inst. Co.
Ferner Co.
Gen. Engg. & Model Wks.
Hayes Scientific Apps.
Metzger & Son
Olsen Testing Machine

EYEGLASSES, POLARIZED (for Photoelastic Work or Strain Observation, etc.)
Polarizing Inst. Co.
Zeiss, Inc., Carl

FADE-OMETER
Atlas Elec. Devices Co.
Gen. Elec. Vapor Lamp

FAULT LOCATORS
Industrial Insts. Inc.
Leeds & Northrup
Rawson Elec. Inst. Co.
Rubicon Co.
Shallcross Mfg. Co.
Tobe Deutschmann Corp.

FEED WATER METERS
Bailey Meter Co.
Brown Inst. Co.
Builders Iron Foundry
Central Station Steam
Cochrane Corp.
Elec. Indicator Co.
Fischer & Porter
Foxboro Co.
Henszey
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Simplex Valve & Meter
Tagliabue Mfg. Co.

FEED WATER TESTING APPARATUS
Allis Chalmers Mfg. Co.
Burrell Technical Supply
Central Scientific Co.
Cochrane Corp.
Electronic Products Co.
G. M. Mfg. Co., Inc.
Hellige, Inc.
Industrial Insts. Inc.
LaMotte Chemical Prod.
Leeds & Northrup Co.
Pfaltz & Bauer, Inc.
Taylor & Co., Inc., W. A.

FIELD RHEOSTATS (See Rheostats, Field)

FIELD-STRENGTH MEASURING SETS
Andrew, Victor J.
Ferris Inst. Corp.
McFarlin Co.
Measurements Corp.
RCA Manufacturing Co.
Tobe Deutschmann Corp.

FILLING MACHINES, Automatic
Anderson Bros. Mfg. Co.
Bowser & Co.
Gump Co., B. F.
Richardson Scale Co.
Syntron Company
Triangle Package Mach.

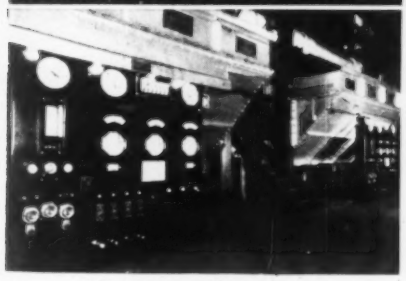
FILLING MACHINES, Bag
Gump Co., B. F.
Richardson Scale Co.
Syntron Company
Triangle Package Mach.

FILLING MACHINES, Barrel
Bowser & Co.

FILLING MACHINES, Can
Anderson Bros. Mfg.
Bowser & Co.
Gump Co., B. F.
Triangle Package Mach.

FILLING MACHINES, Carton
Gump Co., B. F.
Triangle Package Mach.

COMBUSTION CONTROL



All Sizes of Boilers
All Types of Firing

Republic-Smoot combustion control systems are designed for all sizes of boilers and all types of fuel firing equipment.

CONSTANT STEAM PRESSURE

Automatically maintains a constant steam pressure by controlling the fuel and air input to the boilers in balance with the boiler load.

EFFICIENT COMBUSTION

Automatically maintains maximum combustion efficiency over entire range of boiler rating, by controlling simultaneously the fuel and air input to boiler in measured proportions and in a fixed ratio.

LOAD DISTRIBUTION

Automatically distributes load equally among all the boilers, or the load can be distributed between the boilers as desired.

WRITE FOR DATA BOOK No. S-21

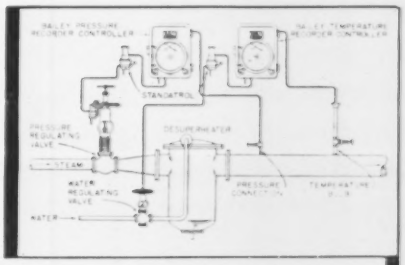
REPUBLIC FLOW METERS CO.
2249 DIVERSEY PKWY., CHICAGO, ILLINOIS

S-M-O-O-T-H
VOLTAGE CONTROL
for A.C. circuits

The Type "TH" Transtat is the new continuously variable auto-transformer regulator . . . the ideal voltage control for a.c. circuits. It offers high efficiency, good regulation, great flexibility and dependable construction at moderate cost. Standard types are available for controlling voltage to single-phase and polyphase loads rated 10 Kva. and smaller, 50 or 60 cycles, 115, 230 or 460 volts. May we send you bulletin 51-1 which contains complete data?

TRANSTAT
VOLTAGE REGULATORS

AMERICAN TRANSFORMER CO.
178 Emmet St. Newark, N. J.



DESUPERHEATING & PRESSURE REDUCING CONTROL

● Bailey Meter Control of desuperheating and pressure reducing incorporates standard Bailey Recorder-Controllers for both pressure and temperature, as well as a special Bailey Reducing Valve equipped with valve positioner and air cooled packing gland.

The control system is air-operated and is arranged to maintain the desired final steam temperature by controlling the quantity of water fed to a cartridge type desuperheater. This temperature is measured by a sensitive bare bulb temperature recorder-controller with the temperature bulb located at the ● outlet of the desuperheater.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

For addresses, see pages 66-76

FILTERS, Light (See also Filters, Optical)
American Inst. Co.
Bausch & Lomb Opt.
Central Scientific Co.
Corning Glass Works
Fish-Schurman Co.
Fuess, Inc.
Kollmorgen Optical Co.
Lenz, Inc.
Perkin-Elmer Corp.
Zeiss, Inc., Carl

FILTERS, Optical
Akatos, Inc.
Bausch & Lomb Optical
Electronic Laboratory
Fecker, J. W.
General Scientific Corp.
Goerz Amer. Optical Co.
Klett Mfg. Co.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Testrite Instrument Co.
Triumph Mfg. Co.
United Cinephone Corp.
Woermann-Schuchhardt

FINDERS, VALVE BOX
Geophysical Inst. Co.

FIRE CONTROL INSTRUMENTS, MILITARY & NAVAL
Elec. Indicator Co.
Fecker, J. W.
Kerri Co.
Kollmorgen Optical Co.
United Cinephone Corp.

FIRING DISKS
Veritas Firing System

FLASH POINT TESTERS (See Testers, Flash Point)

FLASHERS, Neon Tube
Automatic Elec. Mfg. Co.
Bacharach Industrial Inst.
Betts & Betts
Paragon Electric Co.
Sangamo Electric Co.

FLATNESS TESTERS (See Testers, Flatness, Light Wave)

FLATS, OPTICAL
Am. Telescope Labs.
Baird Associates
Bausch & Lomb Optical
Clark & Sons
Ednal Co.
Fecker, J. W.
Fetter Co.
Fish-Schurman Co.
Fuess, Inc.
Gaertner Scientific Corp.
Goerz Amer. Optical Co.
Kollmorgen Optical Co.
(Cont'd)

FLATS, OPTICAL (Continued)
Master Optical Co.
Mico Instrument Co.
Miller Corp., William
Perkin-Elmer Corp.
Scherr Co., Inc., George
Simpson Optical
Spencer Lens
Tinsley Laboratories
Unertl, John
Van Keuren Co.
Wilder, R. S.
Woermann-Schuchhardt
Zeiss, Inc., Carl

FLATS, OPTICAL, Fused Quartz
Bausch & Lomb Opt.
Thermal Syndicate Ltd.

"FLOW"

(Flowmeters measure primarily RATE of flow. For positive or "quantity" fluid meters, see the numerous classes under "Meters")

FLOWMETERS, AIR (See Flowmeters, Gas)

FLOWMETERS, AREA Cone & Disk Type
Cochrane Corp.
Commercial Engg. Labs.
Fischer & Porter
Friez & Sons
National Meter Co.

FLOWMETERS, AREA Cylinder & Piston Type
American Inst. Co.
Bowser & Co.
Brown Inst. Co.
Fischer & Porter
National Meter Co.
New Jersey Meter Co.

FLOWMETERS, AREA Free Float Type
Am. Gas Furnace Co.
D'Este Co.
Fischer & Porter
Fish-Schurman Corp.
Hoke, Inc.
Schutte & Koerting Co.

FLOWMETERS, AREA Orifice & Plug Type
American Meter Co.
Bacharach Industrial Inst.
Binckley, George Sidney
Brown Inst. Co.
Cochrane Corp.
Fischer & Porter
Mason-Neilan Regulator
Republic Flow Meters
Taylor Inst. Cos.

FLOWMETERS, BLAST (See Flowmeters, Gas)

FLOWMETERS, GAS
Ace Glass, Inc.
American Gas Furnace
American Inst. Co.
American Meter Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bowser & Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Fdry.
Clark Blast Meter
Cochrane Corp.
Commercial Engg. Labs.
D'Este Co.
Detroit Air Meter Co.
Eclipse Aviation
Elec. Indicator Corp.
Fischer & Porter
Fish-Schurman Co.
Foxboro Co.
Friez & Sons
Gas Appliance Specialties
Henszey Co.
Hoke, Inc.
Ill. Testing Labs.
International Filter Co.
Jensen Inst. Co.
Kollsman Inst. Co.
Lambert Meter Co.
Leeds & Northrup
Leupold, Volpel & Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
National Meter Co.
New Jersey Meter Co.
Republic Flow Meters
Ring Balance Co.
Schutte & Koerting Co.
Scientific Glass Apparatus
Selas Company
Simplex Valve & Meter
Spray Engg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment Co.

FLOWMETERS, LIQUID (See Flowmeters, Gas)

FLOWMETERS, Open-Stream
Bristol Co.
Builders Iron Fdry.
Cochrane Corp.
Leupold, Volpel & Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Scientific Inst. Co. Calif.
Simplex Valve & Meter

FLOWMETERS, ORIFICE, and NOZZLE
Ace Glass Inc.
American Meter Co.
Askania Regulator Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cochrane Corp.
Commercial Engg. Labs.
Elmer & Amend
Fischer & Porter
Foxboro Co.
Hoke, Inc.
Jensen Inst. Co.
Lambert Meter Co., Inc.
Leeds & Northrup Co.
Leupold, Volpel & Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
Permutit Co.
Pgh. Equitable Meter
Republic Flow Meters
Ring Balance Co.
Ruska & Co., Inc.
Scientific Glass Apparatus
Scientific Inst. Co.
Simplex Valve & Meter
Tagliabue Mfg. Co.
Taylor Inst. Cos.

FLOWMETERS, Pitot Tube
Am. Blower Corp.
American Meter Co.
Askania Regulator Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cambridge Inst. Co.
Central Scientific Co.
Cochrane Corp.
Defender Automatic Reg.
Detroit Air Meter Co.
Foxboro Co.
Friez & Sons
Fuess, Inc.
Kollsman Inst. Co.
Meriam Co.
Morey & Jones, Ltd.
Pitometer Log Corp.
Precision Therm. & Inst.
Refinery Supply Co.
Republic Flow Meters
Ring Balance Co.
Simplex Valve & Meter
Taylor Inst. Cos.

FLOWMETERS, Steam
Am. Dist. Steam Co.
American Meter Co.
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Fdry.
Cochrane Corp.
Foxboro Co.
Jensen Inst. Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
Meriam Co.
Morey & Jones, Ltd.
Republic Flow Meters
Ring Balance Co.
Simplex Valve & Meter
Tagliabue Mfg. Co.
Taylor Inst. Cos.

FLOWMETERS, Vane
Autocall Co.
Detroit Air Meter Co.
Friez & Sons
Ill. Testing Labs.
Mason-Neilan Regulator
Simplex Valve & Meter

FLOWMETERS, Venturi
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Cochrane Corp.
Foxboro Co.
International Filter Co.
Jensen Inst. Co.
Leupold, Volpel & Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Ring Balance Co.
Simplex Valve & Meter
Taylor Inst. Cos.

FLOWMETERS, Weir
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Builders Iron Fdry.
Cochrane Corp.
Elec. Indicator Corp.
Foxboro Co.
Gurley, W. & L. E.
Leupold, Volpel & Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Simplex Valve & Meter
Taylor Inst. Cos.

FLUE GAS ANALYZERS (See Gas Analyzers, Flue Gas)

FLUID METERS, GAS (See Gas Meters)

FLUID METERS, LIQUID (See Meters, Liquid)

FLUID METERS, QUANTITY (See Gas Meters; Meters, Current; Meters, Liquid)

FLUORESCENT CHEMICALS
Central Scientific Co.
Pfaltz & Bauer, Inc.
Patterson Screen Co.

FLUORESCENT MERCURY VAPOR TUBES EMITTING WHITE LIGHT (See Light Sources)

FLUOROSCOPES
General Electric X-Ray
Patterson Screen Co.
Westinghouse X-Ray Co.

FLUXMETERS
Annis Co.
Cambridge Inst. Co.
Central Scientific Co.
General Elec. Co.
Leeds & Northrup Co.
Rawson Electrical Inst.
Rubicon Co.
Sensitive Research Inst.

FOLDING ENDURANCE TESTERS (PAPER) (See Testers, Folding Endurance)

FOOT BLOCKS
Ford Motor Co.

FOOT CANDLE METERS
Central Scientific Co.
De Jur-Amsco Corp.
General Elec. Co.
G-M Labs.
Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Photovolt Corp.
United Cinephone Corp.
Weston Elec. Inst. Corp.

FOREWARN DETECTOR for locating hidden weapons (See Detectors, Metal)

FORKS, Synchronization
Elec. Tachometer Corp.
Gaertner Scientific Corp.
Riverbank Laboratories

FORKS, Tuning
Clay-Adams Co.

FORKS, Tuning, Electrically Driven
American Inst. Co.
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
Elec. Tachometer Corp.
Engineering Labs., Inc.
Gaertner Scientific Corp.
General Radio Co.
Hathaway Inst. Co.
Riverbank Laboratories
Welch Mfg. Co.

FORKS, Vacuum Driven
Cambridge Inst. Co.
Gaertner Scientific Corp.
Riverbank Laboratories

FRACTIONAL HORSE POWER MOTOR (See Motors, Fractional Horsepower)

FREENESS TESTERS (See Testers, Freeness)

FREQUENCY METERS, Controlling
General Elec. Co.
Leeds & Northrup Co.

FREQUENCY Meters, Electronic
De Jur-Amsco Corp.
General Radio Co.
RCA Manufacturing Co.

FREQUENCY METERS, Indicating
General Elec. Co.
General Radio Co.
Hickok Elec. Inst. Co.
Leeds & Northrup Co.
RCA Manufacturing Co.
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

FREQUENCY METERS, Recording
Bristol Co.
Esterline-Angus Co.
General Elec. Co.
Leeds & Northrup Co.
Roller-Smith Co.
Warren Telechron Co.
Westinghouse Elec. & Mfg.

FREQUENCY METERS, Standards
Bliley Electric Co.
Ferris Inst. Corp.
Millen Mfg. Co.
RCA Manufacturing Co.

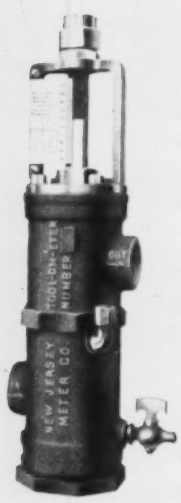
FREQUENCY MFTERS, Vibrating Reed
Biddle Co., Jas. G.

FRITTED GLASS FILTERS & APPARATUS
Central Scientific Co.
Fish-Schurman Co.
Pfaltz & Bauer, Inc.

FUEL ANALYSIS APPARATUS
Central Scientific Co.
Eimer & Amend
Machlett & Son
Parr Instrument Co.
Precision Scientific Co.
Sargent & Co.
Tagliabue Mfg. Co.

New Jersey Air Meters

TOOL-OM-ETER and DRILL-OM-ETER



Measure the flow of Compressed Air to any process or tool. Guide the maintenance of pneumatic equipment in effective working condition.

These meters are of the constant head, variable orifice type, simple, reliable, portable, only one moving part. Used on air and other gases at 1-300 lb.

New Jersey Meter Co.
PLAINFIELD, N. J.

FLOW METERS
For Steam, Gas and Liquids

LOW PRESSURE METERS
Standard Differential Head Range 1" to 8" Water

HIGH PRESSURE METERS
Standard Differential Head Range 20" to 150" of Water

•

RING BALANCE INSTRUMENT CO.
740 N. Franklin St., Chicago, Ill.

JENSEN FLOW GAGE
WITH
Unique Rolling Scale

IS the only Manometer type flow gage with these seven special features:

Patented rolling scale—Direct readings in any unit of flow—Automatic zero check with each reading—Optional piping connections—Instant registrations of counterflows—No corrodable calibrated chambers—Reliable U-tube performance.

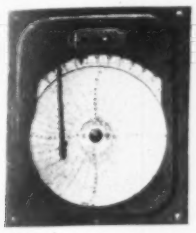
This gage is sturdily built; yet handsome. Standard differential range is 144 inches water using mercury. Standard static range is 300 lbs.

NOTICE

The direct-reading rolling scale for manometers is fully patented. Other manufacturers will please respect our rights

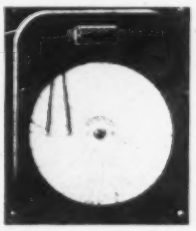
Jensen Instrument Co.
Since 1923
335 CENTRAL AVE. LOS ANGELES
420 MARKET ST. SAN FRANCISCO

For addresses, see pages 66-76



Electric Flow Meter

Mechanical Flow Meter

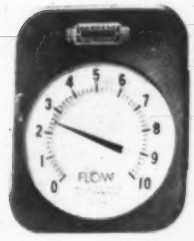


Pressure & Temp. Recorder

COCHRANE FLOW METERS

The Cochrane Meter line is the most complete flow meter line available to American industry. To satisfy all the different problems encountered in the measurement and recording of fluid flow, Cochrane has designed instruments of specific characteristics to meet these problems. Bulletins are available on any and all of these.

Liquid Level Meter



Ring Balance Meter

Linameter

COCHRANE CORP., 3120 N. 17th St., Philadelphia, Pa.

COCHRANE

ANNOUNCING

New F & P STABL-VIS* Rotameter for flow rate measurement unaffected by changing fluid viscosity!

*Trade Mark Reg.

Fischer & Porter Company now offers the STABL-VIS* rotameter designed to eliminate the effect of changing fluid viscosity from flow rate measurement. Based on the sound application of the latest developments in fluid mechanics research, the F & P STABL-VIS rotameter renders negligible the effect of viscosity changes from as low as 0.1 centipoises to as high as 50.0 centipoises on rotameter calibrations.

This F & P development makes complete the superiority of the rotameter sight flow meter over manometer type flow meters. Visibility, accuracy, simplicity of installation, linear scale and corrosion resistance have already established a preference for F & P rotameters with precision-bore tubes. Now, the development of the STABL-VIS rotameter again raises the standards of flow rate measuring practice.

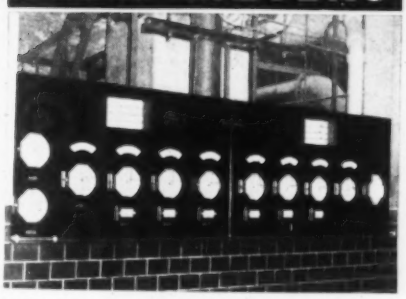
F&P ROTAMETERS

WRITE FOR COMPLETE INFORMATION

FISCHER & PORTER CO.

63 W. QUEEN LANE, PHILADELPHIA, PA.

FLOW METERS



For Measuring the Flow of Steam-Water-Gas-Air-Oil

WORKING PRESSURES

Republic meters are available for all working pressures up to 5000 lb. per sq. in.

RANGE EASILY CHANGED

The range of a Republic meter can be easily and quickly changed by merely changing the range tube.

READING INSTRUMENTS

The Republic indicator, recorder and integrator operate independently of each other and can be supplied separately or in combination. They are remote reading.

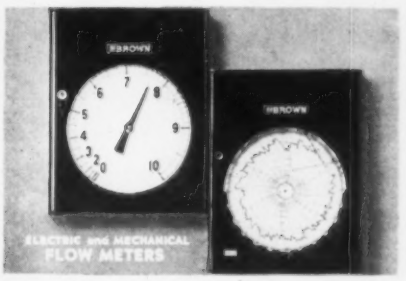
EASILY READ

The indicator scale and the recorder chart all have uniform graduations and are direct reading. The integrator has a large cyclometer type dial.

WRITE FOR DATA BOOK No. 701

REPUBLIC FLOW METERS CO.

2249 DIVERSEY PKWY., CHICAGO, ILLINOIS



For Controlling, Recording, Totalizing and Indicating the Flow of Fluids such as Steam, Water, Gas, Oil, etc.

Brown Flow Meters are available in two types, the Electric type and Mechanical type.

ELECTRIC TYPE: Complete equipment consists of three units, the orifice plate, manometer and instrument. Instrument can be located at a remote point from the orifice and manometer (point of flow measurement).

Because of this flexibility, it is particularly adaptable for applications where instruments are to be remotely located. Write for Catalog 2007.

MECHANICAL TYPE: Complete equipment consists of two units, the orifice plate and the instrument. The meter body is integral with the instrument. Readings are transmitted mechanically from meter body to instrument. Write for Catalog 2203.

THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4482 Wayne Avenue, Philadelphia, Pa.

BROWN FLOW METERS
AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS

To Measure and Control is to Economize

BAILEY
Fluid Meters

For STEAM · LIQUIDS · GASES

● Bailey Fluid Meters are designed to indicate, record and integrate the flow of steam, liquids, or gases under practically any pressure or temperature condition.

A great variety of indicating, recording and integrating combinations are available for use with four distinct types of flow mechanisms.

This large variety of possible combinations enables the flow meter engineer to specify equipment which is pre-eminently suited to any flow measuring application.

When it is desired to place indicators, recorders and integrators at a considerable distance from the primary element, Bailey Synchro-Meters are available to provide electric transmission.

For detailed information consult Sweet's Engineering Catalogs or request a copy of bulletin No. 301.

BAILEY METER COMPANY

1041 IVANHOE ROAD · CLEVELAND, O.

Bailey Meter Company Ltd., Montreal, Canada

FUEL FLOW INDICATORS
Askania Regulator Co.
Autocall Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Commerical Eng. Labs.
Eclipse Aviation
Fischer & Porter
Foxboro Co.
Mason-Neilan Regulator
National Airoil Burner
Pioneer Instrument
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment Co.

FURNACE CONTROL SYSTEMS (See Controllers, Automatic)

FURNITURE, LABORATORY
Hamilton Mfg. Co.
Kewaunee Mfg. Co.
Kimball Co., W. W.
Laboratory Const. Co.
Laboratory Furniture Co.
Moline Furniture Works
Sheldon & Co.
Sjostrom Co.
Southern Desk Co.
Welch Mfg. Co.

FUSES, INSTRUMENT
Littelfuse Labs.
Meter Devices Co.

GAGE BLOCKS
Ford Motor Co.
Illinois Tool Works
Pratt & Whitney
Scherr Co., George
Standard Gage Co.
Van Keuren Co.

GAGE GLASS ILLUMINATORS
Wright-Austin Co.

GAGE TESTERS, Dead-weight
American Inst. Co.
Amthor Testing Inst. Co.
Ashton Valve Co.
Consol. Ashcroft-Hancock
Crosby Steam Gage Co.
Holz, Herman A.
Olsen Testing Machine
Pioneer Instrument
Refinery Supply Co.
Star Brass Mfg. Co.

GAGE TESTERS, Fluid-scale
Crosby Steam Gage Co.

GAGE TESTERS, Liquid-column
Consol. Ashcroft-Hancock
Pioneer Instrument

GAGES (See also object of Measurement and control)

GAGES, Absolute Pressure
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft-Hancock
Emery Co.
Foxboro Co.
Kollsman Inst. Co.
Mason-Neilan Regulator
Moeller Instrument Co.
Pioneer Instrument
Precision Therm. & Inst.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.
United States Gauge Co.
Victor Equipment Co.

GAGES, Air
Ashton Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Bristol Co.
Consol. Ashcroft-Hancock
Detroit Air Meter Co.
Foxboro Co.
Friez & Sons
Lambert Meter Co., Inc.
Marsh Corp.
Mason-Neilan Regulator
Rochester Mfg. Co.
Star Brass Mfg.
Tagliabue Mfg. Co.
Trerice Co.
Uehling Inst. Co.
U. S. Gage Co.
Victor Equipment Co.

GAGES, Alarm
Ashton Valve Co.
Bailey Meter Co.
Bristol Co.
Consol. Ashcroft-Hancock
Crosby Steam Gage
Foxboro Co.
Marsh Corp.
Mason-Neilan Regulator
Precision Therm. & Inst.
Star Brass Mfg.
Trerice Co.
U. S. Gage Co.

GAGES, Amplifying
Coats Mach. Tool Co.
Comtor Co.
Federal Prod. Corp.
Precision Gage & Tool
Saxl Instr. Co.
United Cinephone Corp.

GAGES, Automatic Sorting
Instrument Specialties Co.

GAGES, Bore
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.
Pratt & Whitney
Scherr Co.
Sheffield Gage

GAGES, Bourdon
Ashton Valve Co.
Bailey Meter Co.
Baldwin-Southwark Corp.
Bastian-Blessing Co.
Belfield Co.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Crosby Steam Gage
Dickson Co.
Emery Co.
Foxboro Co.
Hays Corp.
Heise Bourdon Tube Co.
Hoke, Inc.
Improved Gauge Mfg.
Marsh Corp.
Mason-Neilan Regulator
Merceid Corp.
Pioneer Instrument
Republic Flow Meters
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
United States Gauge Co.

GAGES, Caliper (Dial)
Brown & Sharpe
Federal Prod. Corp.
Glogau & Co.
Starrett Co.

GAGES, Center
Lufkin Rule Co.
Millers Falls Co.
Starrett Co.
Union Tool Co.

GAGES, Comparator
Ames Co., B. C.
Coats Mach. Tool Co.
Comtor Co.
Federal Prod. Corp.
Gaertner Scientific Corp.
General Engg. & Model
Instrument Specialties Co.
Jones & Lamson Machine
Pratt & Whitney
Precision Gage & Tool
Saxl Inst. Co.
Scherr Co.
Sheffield Gage
United Cinephone Corp.

GAGES, Compression
Bacharach Indus. Inst.
G. M. Co. Mfg.
Riehle Div.
Saxl Inst. Co.
Toledo Scale Co.
United States Gauge Co.

GAGES, Cylinder
Ames Co., B. C.
Coats Mach. Tool
Comtor Co.
Federal Prod. Corp.
Lufkin Rule Co.
Pratt & Whitney
Starrett Co.
United Cinephone
Victor Equipment

GAGES, Depth, Linear
Ames Co., B. C.
Brown & Sharpe
Glogau & Co.
Instrument Specialties
Lufkin Rule Co.
Park Sales
Pratt & Whitney
Starrett Co.
Union Tool Co.

GAGES, Depth, Navigational
Geophysical Inst. Co.

GAGES, Dial, Machinists'
Ames Co., B. C.
Brown & Sharpe
Chicago Dial Ind.
Federal Prod. Corp.
Ferner Co.
Genales, Andrew
General Engg & Model
Randall, Frank E.
Starrett Co.
Waltham Dial Gage

GAGES, Differential Pressure
American Meter Co.
Bacharach Industrial Inst.
(Cont'd)

GAGES, Differential Pressure (Continued)
Bailey Meter Co.
Binckley, G. S.
Boiler Room Equip.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hanc
Crosby Steam Gage
Defender Automatic R
Detroit Air Meter Co.
Dwyer Mfg. Co.
Ellison Draft Gage Co.
Foxboro Co.
Friez & Sons
Fuess, Inc.
Gas Appliance Specialties
Hays Corp.
Jensen Inst. Co.
Lambert Meter Co.
Mason-Neilan Regulator
Meriam Co.
Moeller Instrument
Morey & Jones, Ltd.
Pioneer Instrument
Pittometer Log Corp.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Republic Flow Meters
Scientific Glass Apparatus
Scientific Inst. Co.
Simplex Valve & Meter
Tagliabue Mfg. Co.
Taylor Inst. Co.
Uehling Instrument Co.
U. S. Gage Co.

GAGES, Draft (See Gages, Differential Pressure)

Taylor

VOLUMETRIC PRESSURE GAUGES

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MARSH PRESSURE GAUGES

• Marsh Pressure Gauges are known for accuracy and their ability to stay accurate. Pressure gauges in all standard ranges up to 20,000 pounds—also vacuum, altitude, compound and recording gauges. An outstanding feature is the "Recalibrator" — far superior to the ordinary "zero" adjustment. The latest addition to the Marsh-line is the new Marsh "Mastergauge" series—gauges tremendously advanced in accuracy and stamina.

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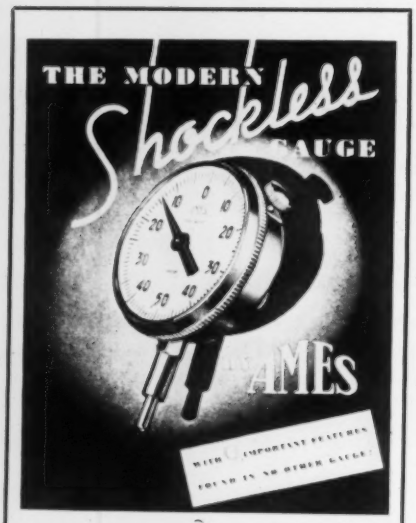
The Marsh line also includes dial thermometers, steam traps, radiator air valves and supply valves, vents, etc. Ask for bulletins.



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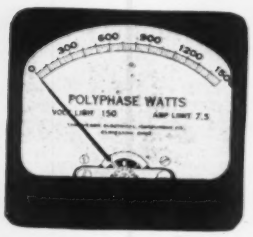

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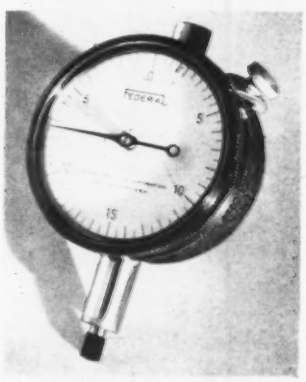

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For addresses, see pages 66-76

GAGES, Drill Grinding
Lufkin Rule Co.
Morse Twist Drill
Starrett Co.
Union Tool Co.
Van Keuren Co.

GAGES, Feeler
Improved Gauge Mfg.
Lufkin Rule Co.
Millers Falls Co.
Starrett Co.
Union Tool Co.
Van Keuren Co.

GAGES, Gas
Abercrombie Pump Co.
American Meter Co.
Bailey Meter Co.
Bastian-Blessing
Bristol Co.
Connelly Iron Sponge
Detroit Air Meter
Dickson Co.
Foxboro Co.
Gas Appliance Specialties
Lambert Meter Co.
Mason-Neilan Regulator
Rochester Mfg. Co.
Specialty Glass Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Victor Equipment

GAGES, Grinding
Ames Co., B. C.
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.
Lufkin Rule Co.

GAGES, Height
Brown & Sharpe
Ford Motor Co.
General Engg. & Model
Lufkin Rule Co.
Scherr Co.
Starrett Co.

GAGES, Hook
Gurley, W. & L. E.
Scientific Inst. (Calif.)
White Co., The

GAGES, Hydrostatic
(See Gages, Liquid Level, Indicating)

GAGES, Internal Dial
Coats Mach. Tool
Comtor Co.
Federal Prod. Corp.
Gen. Engg. & Model Wks.
Scherr Co.

GAGES, Limit
Ford Motor Co.
General Elec. Co.
Gen. Engg. & Model Wks.
Greenfield Tap & Die
M-G Gage Corp.
Pratt & Whitney
Sheffield Gage
United Cinephonic
Van Keuren Co.

GAGES, Liquid Level, Indicating
American Meter Co.
Ashton Valve Co.
Autocall Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Bastian-Blessing
Binckley, G. S.
Bin-Dicator Co.
Boston Auto Gage
Bowser & Co.
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Burt Scientific Labs.
Certified Gauge
Cochrane Corp.
Consol. Ashcroft Hancock
Crosby Steam Gage
Davis Reg. Co.
Defender Automatic Reg.
Dickson Co.
Elec. Indicator Corp.
Elec. Tachometer Corp.
Fisher Governor Co.
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General Controls Co.
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Gurley, W. & L. E.
Hanlon-Waters, Inc.
International Filter Co.
Jensen Inst. Co.
Jerguson Gage Co.
Johnston & Jennings
Kellogg Switchboard
King-Seeley
Klingerit, Inc.
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Liquidometer Co.
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Luxtrol Co., Inc.
Marsh Corp.
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McAlear Mfg. Co.
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Meriam Co., The
Morey & Jones, Ltd.
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Natural Gas Equipment
Paragon Electric
Penberthy Injector Co.
Petrometer Corp.
Pioneer Instrument Co.
Pneumercator Co., Inc.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Reliance Gauge Column
Republic Flow Meters
Rochester Mfg. Co.
Schutte & Koerting Co.
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GAGES, Liquid Level, Indicating (Cont'd)
Simplex Valve & Meter
Star Brass Mfg.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Instrument Co.
U. S. Gauge Co.
Vapor Recovery Systems
Wallace & Tiernan
Westinghouse Elec. & Mfg.
Wheelco Inst. Co.
Williams Gauge Co.
Wright-Austin Co.
Yarnell-Waring Co.

GAGES, Liquid Level, Recording (See Gages, Liquid Level, Indicating)

GAGES, Loss of Head
Bailey Meter Co.
Binckley, G. S.
Bristol Co.
Builders Iron Foundry
Foxboro Co.
International Filter Co.
Jensen Inst. Co.
Morey & Jones, Ltd.
Taylor Inst. Cos.

GAGES, Mercury
Amthor Testing Mach.
Bacharach Industrial Inst.
Bailey Meter Co.
Builders Iron Foundry
Central Scientific
Connelly Iron Sponge
Consol. Ashcroft Hancock
Defender Automatic Reg.
Dubrovin, John
Dwyer Mfg. Co.
Eimer & Amend
Gas Appliance Specialties
General Physical Lab.
Heise Bourdon Tube Co.
Jensen Inst. Co.
Machlett & Son
Mason-Neilan Regulator
Meriam Co.
Moeller Instrument
Morey & Jones
Precision Therm. & Inst.
Refinery Supply Co.
Scientific Glass Apparatus
Simplex Valve & Meter
Specialty Glass Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
Uehling Instrument Co.

GAGES, Micrometer
Ames Co., B. C.
Amthor Testing Mach.
Brown & Sharpe
Central Scientific Co.
Coats Mach. Tool Co.
Gaertner Scientific Corp.
Haines Gauge Co.
Instrument Specialties Co.
Lufkin Rule Co.
Millers Falls Co.
Precision Therm. & Inst.
Scherr Co.
Van Keuren Co.
Zeiss, Inc., Carl

GAGES, Oil (See Gages, Liquid Level)

GAGES, Optical
Bausch & Lomb Optical
Chicago Dial Ind. Co.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Jarrell-Ash Co.
Jones & Lamson Machine
Scherr Co.
United Cinephone Corp.
Zeiss, Inc., Carl

GAGES, Paint Film
General Elec. Co.
Hathaway Inst. Co.
Instrument Specialties Co.
Munsell Color Co.
Saxl Inst. Co.

GAGES, Paper Thickness (See Gages, Thickness)

GAGES, Piston Ring
Littelfuse Inc.
Wilkening Mfg. Co.

GAGES, Pitch Diameter
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Lufkin Rule Co.
Pratt & Whitney
Scherr Co., Inc.
Union Tool Co.
Van Keuren Co.

GAGES, Plug
West & Dodge Thr. Gage
Brown & Sharpe
Ford Motor Co.
Greenfield Tap & Die
Morse Twist Drill
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
West & Dodge Thr. Gage

GAGES, Pneumatic Tank
Bacharach Industrial
Mason-Neilan Regulator
Pneumercator Co.
Rochester Mfg. Co.
Uehling Inst. Co.

GAGES, Precision Measuring
Ames Co., B. C.
Brown & Sharpe
Comtor Co.
Federal Prod. Corp.
Ferner Co.
Ford Motor Co.
Gaertner Scientific Corp.
Instrument Specialties
Lufkin Rule Co.
Pratt & Whitney
Ricker Instrument Co.
Scherr Co., Inc.
Sheffield Gage
Starrett Co.
Thwing-Albert Inst. Co.
Van Keuren Co.
Carl Zeiss, Inc.

GAGES, Pressure, Indicating
Abercrombie Pump Co.
American Meter Co.
Ashton Valve Co.
Bacharach Industrial Inst.
Bailey Meter Co.
Baird Associates
Baldwin-Southwark Corp.
Bastian-Blessing
Bellfield Co.
Boekel & Co.
(Cont'd)

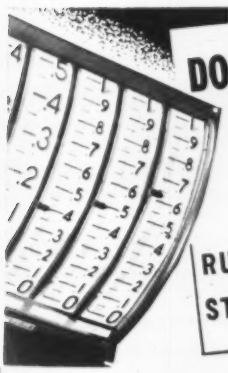
GAGES, Pressure, Indicating (Continued)
Bristol Co.
Brown Inst. Co.
Brush Development Co.
Central Scientific Co.
Certified Gauge
Clark Blast Meter
Commercial Eng. Labs.
Consol. Ashcroft Hancock
Continental Elec. Co.
Crosby Steam Gage
Defender Automatic Reg.
Dickson Co.
Dubrovin, John
Eimer & Amend
Emery Co.
Esterline Angus Co.
Fisher Scientific Co.
Foxboro Co.
Fredericks, George
Friez & Sons
Gas Appliance Specialties
General Elec. Co.
General Physical Lab.
Gotham Inst.
Green, Henry J.
Hays Corp.
(Cont'd)

Taylor

PRESSURE AND VACUUM GAUGES
INDICATING, RECORDING, CONTROLLING

Write for complete information and catalogs.

Taylor Instrument Companies
ROCHESTER, N.Y. TORONTO, CANADA



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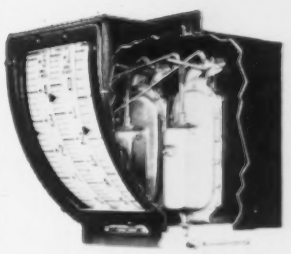
The true value of a pressure gauge lies in the measuring element. Foxboro offers you the ideal type for each class of pressure measurement from a full vacuum to 20,000 lbs. When you specify Foxboro Indicating or Recording Gauges you can be sure of accuracy and capacity to withstand continuous service over long periods of time.

Write for information and specifications on the type of instrument you need . . . and send us details of the service requirements. The Foxboro Company, 46 Neponset Avenue, Foxboro, Massachusetts, U. S. A. Branch offices in principal cities of United States and Canada.



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● Bailey Multi-Pointer Gages are made with any number of pointers and any scale combination from one to twelve. The pointers have 10° motion over plainly marked plastic molded scales so that readings can be taken at a distance of 20 feet. Diaphragm actuated elements enable this gage to withstand over-drafts and over-pressures without injury to the unit or its calibration.

All secondary factors such as draft pressure, temperature, stoker speed and pulverizer feed can be indicated on one Bailey Multi-Pointer Gage.

BAILEY METER COMPANY
1041 IVANHOE ROAD · CLEVELAND, O.
Bailey Meter Company Ltd., Montreal, Canada

For addresses, see pages 66-76

U. S. PRESSURE GAUGES

ARE RUGGED,
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ACCURATE.

U. S. GAUGE CO.

Makers of Indicating and Recording Pressure Gauges

ALL SIZES AND TYPES
FOR EVERY PURPOSE

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King-Seeley Corp.
Kollsman Inst. Co.
Kurman Electric Co.
Leeds & Northrup
Leupold, Volpel & Co.
Logansport Machine
Marsh Corp.
Mason-Neilan Regulator
Mercoid Corp.
Meriam Co.
Moeller Instrument Co.
Parks Co., Harry S.
Pioneer Instrument
Pittsburgh Equitable Met.
Plumb Co., Inc.
Precision Gage & Tool
Precision Therm. & Inst.
Preferred Utilities Mfg.
RCA Manufacturing Co.
Refinery Supply Co.
Republic Flow Meters
Rochester Mfg. Co.
Scientific Inst. Co.
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
Uehling Instrument Co.
United Cinephone Corp.
U. S. Gauge Co.
Victor Equipment Co.
Wagner & Son, Carl H.
Welch Mfg. Co.
Wilgus Manufacturing

GAGES, Pressure—Recording (See Gages, Pressure, Indicating)

GAGES, Pressure Temperature (See Gages, Pressure Indicating)

GAGES, Pressure, Tire
Air Balance Inst. Co.
U. S. Gauge Co.

GAGES, Pressure & Vacuum (See Gages, Pressure Indicating)

GAGES, Profile
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
Stockton Profile Gauge
United Cinephone Corp.

GAGES, Radius
Lufkin Rule Co.
Starrett Co.
United Cinephone Corp.

GAGES, Rain (See Rain Gages)

GAGES, Rifle Bore
Hathaway Inst. Co.
Pratt & Whitney

GAGES, Ring
Brown & Sharpe
Greenfield Tap & Die
Morse Twist Drill
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage
West & Dodge Thread
Zeiss, Inc., Carl

GAGES, Screw Thread
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Lufkin Rule Co.
(Cont'd)

GAGES, Screw Thread (Continued)
Millers Falls Co.
Pratt & Whitney
Reed Small Tool Works
Sheffield Gage
Starrett Co.
Union Tool Co.
West & Dodge Thread
Zeiss, Inc., Carl

GAGES, Sliding
Pratt & Whitney
Van Keuren Co.

GAGES, Snap
Brown & Sharpe
Gen. Engg. & Model Wks.
Greenfield Tap & Die
M-G Gage Corp.
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage

GAGES, Spline
Brown & Sharpe
Pratt & Whitney
Precision Gage & Tool
Sheffield Gage

GAGES, Star
Pratt & Whitney

GAGES, Strain
American Inst. Co.
Baldwin-Southwark
Binckley, G. S.
General Elec. Co.
Hathaway Inst. Co.
Metzger & Son
Miller Corp., Wm.
Olsen Testing Machine
Pratt & Whitney
Saxl Inst. Co.
Starrett Co.

GAGES, Surface
Ames Co., B. C.
Brown & Sharpe
Genales, Andrew
Federal Prod. Corp.
Lufkin Rule Co.
Millers Falls Co.
Saxl Inst. Co.
Starrett Co.
Zeiss, Inc., Carl

GAGES, Taper
Brown & Sharpe
Federal Prod. Corp.
Precision Gage & Tool
Pratt & Whitney
Sheffield Gage
Starrett Co.

GAGES, Telescoping
Brown & Sharpe
Lufkin Rule Co.
Pacific Specialty Supply
Starrett Co.

GAGES, Thickness
American Askania Corp.
Ames Co., B. C.
Amthor Testing Inst. Co.
Brown & Sharpe
Federal Prod. Corp.
Ford Motor Co.
General Elec. Co.
Gen. Engg. & Model Wks.
Hathaway Inst. Co.
Ill. Testing Labs.
Instrument Specialties Co.
Lufkin Rule Co.
Magnetic Gauge Co.
Metzger & Son
Millers Falls Co.
Pratt & Whitney
Precision Gage & Tool
Precision Therm. & Inst.
Randall, Frank E.
Saxl Inst. Co.
Sheffield Gage
Speidel & Co.
Starrett Co.
Suter, Alfred
Thwing-Albert Inst. Co.
Union Tool Co.
Van Keuren Co.
Waltham Dial Gage

GAGES, Thickness, Magnetic
American Inst. Co.
Commercial Eng. Labs.
General Elec. Co.
Hathaway Inst. Co.
Hickok Elec. Inst. Co.
Magnetic Gauge Co.

GAGES, Tide
American Inst. Co.
Ballauf Mfg. Co.
Binckley, G. S.
Uehling Instrument Co.

GAGES, Torque
Martin Decker Corp.
Riehle Div.
Saxl Inst. Co.
Toledo Scale Co.

GAGES, Vacuum (See Gages, Pressure)

GAGES, Venturi (See Flow Meters, Venturi)

GAGES, Water Level (See Gages, Liquid Level)

GAGES, Wind
American Inst. Co.
Detroit Air Meter
Friez & Sons
Fuess, Inc.
Green, Henry J.
Kenyon Instrument Co.
Rieker Inst. Co.
Taylor Inst. Cos.

GAGES, Wire Measuring
Ames Co., B. C.
Brown & Sharpe
Federal Prod. Corp.
Greenfield Tap & Die
Hathaway Inst. Co.
Instrument Specialties Co.
Pratt & Whitney
Starrett Co.

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Cambridge Inst. Co.
Central Scientific Co.
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Hathaway Inst. Co.
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Leeds & Northrup Co.
Pfaltz & Bauer, Inc.
Rawson Electrical Inst.
Rubicon Co.
Ruska & Co.
Sensitive Research Inst.
Tagliabue Mfg. Co.
Welch Mfg. Co.
Weston Elec. Inst.
Wheelco Inst. Co.

GALVANOMETERS, Astatic
Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
Hathaway Inst. Co.
Leeds & Northrup Co.
Rawson Electrical Inst.
Sensitive Research Inst.
Tagliabue Mfg. Co.
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GALVANOMETERS, D-c.
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Cambridge Inst. Co.
Central Scientific Co.
Chicago Apparatus Co.
General Elec. Co.
G-M Labs.
Hathaway Inst. Co.
Hickok Elect. Inst. Co.
J-B-T Instruments
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Pfaltz & Bauer, Inc.
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Roller-Smith Co.
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Sensitive Research Inst.
Shallcross Mfg. Co.
Simpson Elec. Co.
Tagliabue Mfg. Co.
Thwing-Albert Inst.
Triplett Electrical Inst.
W. M. Welch Mfg. Co.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

GALVANOMETERS, Piezoelectric
Brush Development Co.

GALVANOMETERS, Reflecting
Rawson Electrical Inst.

GALVANOMETERS, Vacuum-tube
Engineering Labs., Inc.
Hathaway Instrument Co.
Measurements Corp.
National Technical Labs.
Tagliabue Mfg. Co., C. J.

GALVANOSCOPES
Central Scientific Co.

GAS ANALYZERS, Air
Burrell Technical Supply
Cambridge Inst. Co.
Central Scientific Co.
Eimer & Amend
Fish-Schurman Co.
Fisher Scientific Co.
Friez & Sons
Hebler Co.
Mercoid Corp.
Mine Safety Appliances
Permutit Co.
Sargent & Co.
Scientific Glass App.
Tagliabue Mfg. Co.
Willson Products, Inc.

GAS ANALYZERS, Ammonia
Burrell Technical Supply
Cambridge Inst. Co.
Engelhard, Chas.
Mercoid Corp.
Permutit Co.
Sargent & Co.
Tagliabue Mfg. Co.

GAS ANALYZERS, Carbon Dioxide
Ace Glass Inc.
Bacharach Industrial Inst.
Brown Inst. Co.
Cambridge Inst. Co.
Central Scientific Co.
Defender Automatic Reg.
Dwyer Mfg. Co.
Eimer & Amend
Ellison Draft Gage Co.
Engelhard, Chas.
Fish-Schurman Co.
Fisher Scientific Co.
Friez & Sons
Gow-Mac Instrument
Hays Corp.
Hebler Co.
Lantz-Phelps Corp.
Leeds & Northrup Co.
Machlett & Son
Permutit Co.
Potter Co.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Republic Flow Meters
Sargent & Co.
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Uehling Instrument Co.
Williams Apparatus Co.

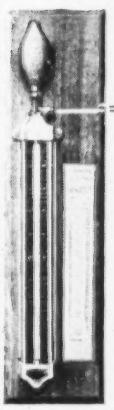
GAS ANALYZERS, Carbon Monoxide
Bacharach Industrial Inst.
Burrell Technical Supply
Cambridge Inst. Co.
Chicago Apparatus Co.
Eclipse Aviation
Eimer & Amend
Fish-Schurman Co.
Hays Corp.
Leeds & Northrup Co.
Machlett & Son
Mine Safety Appliances
Sargent & Co.
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.

GAS ANALYZERS, Chlorinated Hydrocarbons
Willson Products, Inc.

GAS ANALYZERS, Flue Gas (See Gas Analyzers, Carbon Dioxide)

GAS ANALYZERS, Hydrogen
Bacharach Industrial Inst.
Burrell Technical Supply
Chicago Apparatus Co.

GAS ANALYZERS, Hydrogen Sulphide
American Meter
Brown Inst. Co.
Burrell Technical Supply
Bushnell & Nevins
Cambridge Inst. Co.
Connelly Iron Sponge
Eimer & Amend
Johnson-Williams, Ltd.
Mine Safety Appliances
Sargent & Co.
Scientific Glass Apparatus



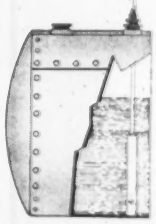
PETROMETER is an instrument for indicating at a remote location the vertical depth of liquid in tanks.

PETROMETER will indicate gallonage or weight of liquids. It may also be used as a remote reading Hydrometer.

TANK GAUGING EQUIPMENT

PETROMETER

PETROMETER is used for all kinds of liquids, lighter or heavier than water, stored in any type of tank or container made of steel, glass, hard rubber, concrete or other kinds of materials.



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LONG ISLAND CITY, N. Y.

CAMBRIDGE POT GALVANOMETER ... *rugged* ... *inexpensive*

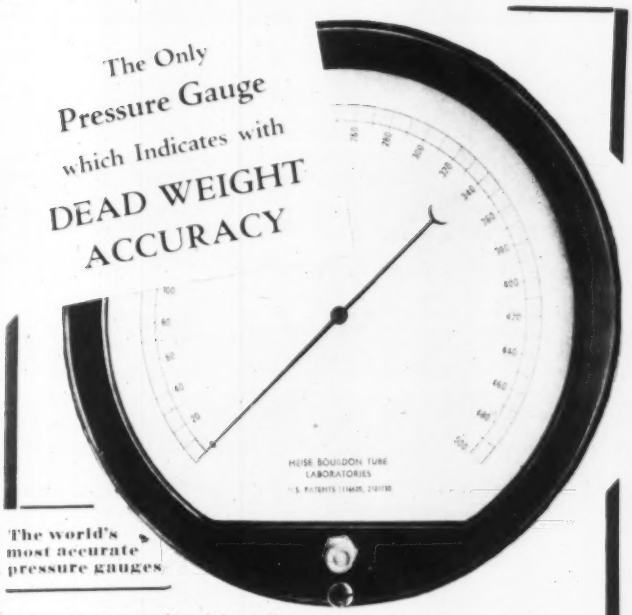
THIS GALVANOMETER is a small, inexpensive instrument with the sensitivity of a reflecting galvanometer and the ruggedness of a milliammeter. It requires no levelling or clamping and is accordingly well adapted for general laboratory use. It is fitted with both a pointer and a reflecting mirror suitable for "null" point indications as well as for use with a lamp and scale. It is only one of many Cambridge Galvanometers.

CAMBRIDGE FURNISHES a wide range of instruments for high and low frequency measurements for use in standardizing, research and commercial testing laboratories. Literature describing a wide range of instruments suitable for precise measurements of both D.C. and A.C. current, voltage and power, will be sent upon request. Instruments will be constructed to meet special requirements.

CAMBRIDGE INSTRUMENT CO., INC. 3732 Grand Central Terminal
Pioneer Manufacturers of Precision Instruments New York, N. Y.

For addresses, see pages 66-76

The Only
Pressure Gauge
which Indicates with
DEAD WEIGHT
ACCURACY



The world's most accurate pressure gauges

Heise Extreme Precision Gauges provide the quickest *reliable* way of testing: (1) for faster results where dead weight testers have been used, (2) inspectors' gauges, (3) new ordinary gauges. Indispensable to manufacturers of equipment which includes gauges. *Important feature:* revolving dial simplifies calculations by eliminating tare figure. Zero setting is instantaneous from front of bezel and self locking.

Note. Prices are surprisingly low. Example, $120 for a ten-inch (11¾" O.D.) gauge with 500 graduations.

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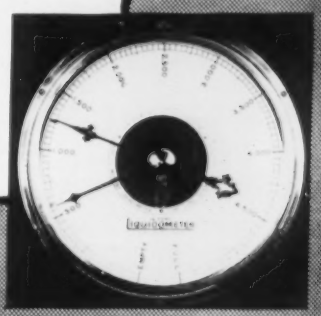

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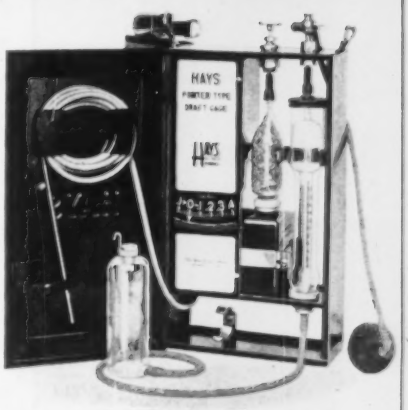

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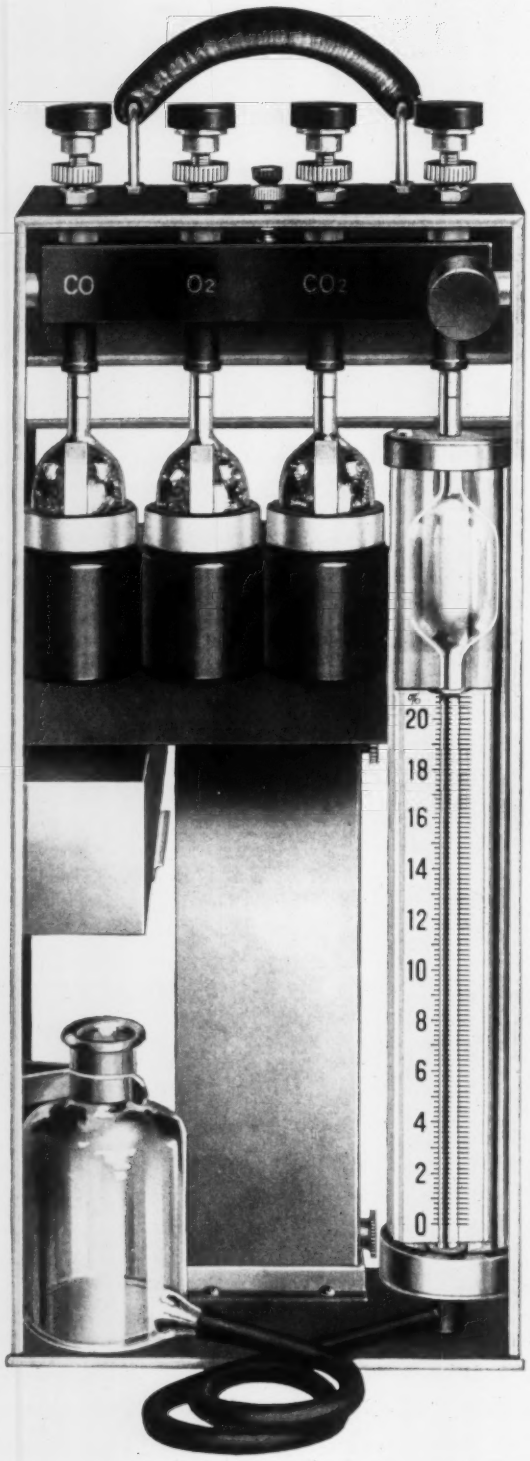

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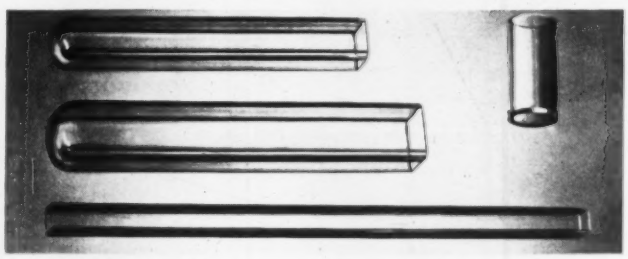

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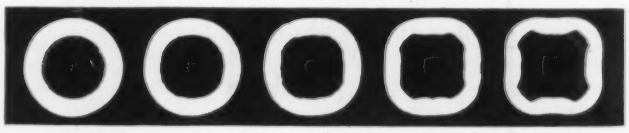

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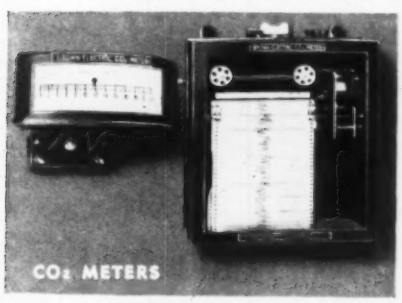

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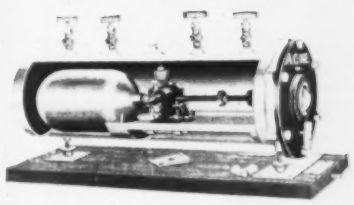

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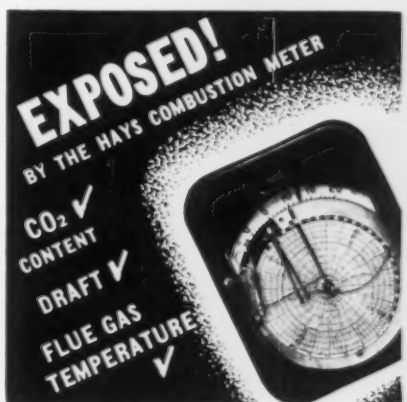

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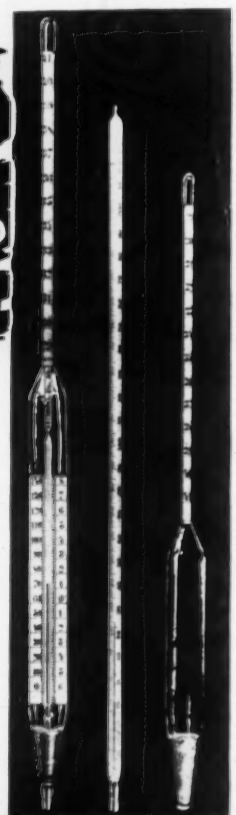

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INCLINOMETERS, Bore Hole
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INCLINOMETERS, Ship
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INDEXES, Base Volume & Base Pressure
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INDICATORS (Look under the object of measurement and control)

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Bacharach Industrial Inst.
Baldwin-Southwark Corp.
Bendix Marine Products
Cambridge Inst. Co.
Commercial Engg. Labs.
Crosby Steam Gage Co.
McNab of Bridgeport
Pioneer Instrument Co.
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Star Brass Mfg. Co.
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Bacharach Industrial Inst.
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Commercial Engg. Labs.
G. M. CO Mfg. Co.
RCA Manufacturing Co.
Trill Indicator Co.

INDICATORS, Ignition Lag
American Inst. Co.

INDICATORS, Multiple Recording
Commercial Engg. Labs.

INDICATORS, Rate of Climb
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Kollsman Inst. Co.
Pioneer Instrument Co.
Rieker Inst. Co.

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Clough-Brengle Co.
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Electronic Design Corp.
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Premier Crystal Labs.
RCA Manufacturing Co.
Rubicon Co.
Shallcross Mfg. Co.
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Electronic Prod. Co.
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Clark & Sons
Perkin-Elmer Corp.

LENSES, Burette
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G. M. Mfg. Co., Inc.
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National Research Corp.

LENSES, Microscope, etc.
Bausch & Lomb Optical
Gaertner Scientific Corp.
Leitz, Inc.
Pfaltz & Bauer, Inc.
Spencer Lens Co.
Zeiss, Inc., Carl

LENSES, Polarized
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Polarizing Inst. Co.
Valpey Crystals
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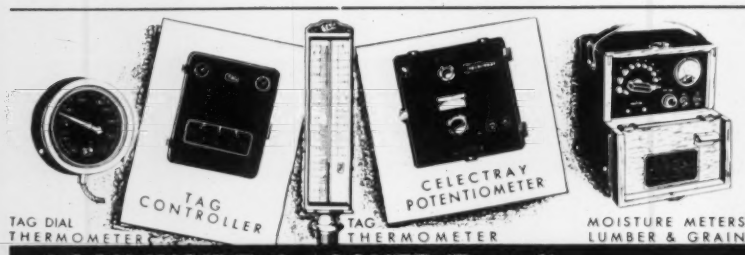

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(See Lenses, Burette)

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Keuffel & Esser Co.
Ruchfel Co.
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LEVELS, Dumpy (See Surveying Instruments)

LEVELS, Engineer's (See Surveying Instruments)

LEVELS, Hand
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Leupold, Voipel & Co.
Pittsburgh Inst. & Mach.
Starrett Co.
United States Blue Print
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Weber Co., F.
White Co. Inc., David

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Glogau & Co.
Gurley, W. & L. E.
Kern Co.
Keuffel & Esser Co.
Leupold, Voipel & Co.
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Ricker Instrument Co.
Scherr Co., Inc.
Starrett Co.
Warren-Knight Co.
Weber Co., F.
White Co. Inc., David
Zeiss, Inc., Carl

LEVELS, Prism
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Kern Co.
Keuffel & Esser Co.
Taylor Inst. Cos.
White Co. Inc., David

LEVELS, Surveying (See Surveying Instruments)

LEVELS, Wye (See Surveying Instruments)

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Pho-Tron Inst. Co.
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Welch Mfg. Co.

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General Physical Lab.

LIGHT SOURCES, "Daylight"
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Frober-Faybor Co.
General Elec. Co.
Macbeth Daylighting Co.
General Physical Lab.

LIGHT SOURCES, Incandescent
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Bausch & Lomb Opt.
Fredericks, George
Gaertner Scientific Co.
General Elec. Co.
General Physical Lab.
G-M Labs.
Leitz, Inc., E.
Luxtrol Co., Inc.
United Cinephone Corp.

LIGHT SOURCES, Mercury Vapor
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Barkon-Frink
Bausch & Lomb Opt.
Central Scientific Co.
Fish-Schurman Co.
Gaertner Scientific Corp.
Gen. Elec. Lamp Dept.
General Physical Lab.
Hanovia Chem. & Mfg.
Jarrell-Ash Co.
Leitz, Inc.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Polarizing Instrument
United Cinephone Corp.

LIGHT SOURCES, Mono-chromatic
Akatos, Inc.
American Inst. Co.
Bausch & Lomb Opt.
Central Scientific Co.
Fish-Schurman Co.
Fuess, Inc.
Gaertner Scientific Corp.
Gen. Elec. Lamp Dept.
General Physical Lab.
Jarrell-Ash Co.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
Polarizing Instrument
Van Keuren Co.
United Cinephone Corp.

LIGHT SOURCES, Neon
Barkon-Frink
Fredericks, George
Gen. Elec. Lamp Dept.
General Physical Lab.
United Cinephone Corp.
Xervac Inst. Co.

LIGHT SOURCES, Sodium
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Central Scientific Co.
Fredericks, George
Gaertner Scientific Corp.
Gen. Elec. Lamp Dept.
Jarrell-Ash Co.
Leitz, Inc.
Pfaltz & Bauer, Inc.
United Cinephone Corp.
Zeiss, Inc., Carl

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Atlas Electric Devices
Central Scientific Co.
Fredericks, George
Gaertner Scientific Corp.
General Physical Lab.
Hanovia Chem. & Mfg.
Jarrell-Ash Co.
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Leitz, Inc.
Mico Instrument Co.
Pfaltz & Bauer, Inc.
United Cinephone Corp.
Westinghouse X-Ray Co.

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Fredericks, George
Gaertner Scientific Corp.
Gen. Elec. Lamp Dept.
General Physical Lab.
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Leitz, Inc.
Saxl Inst. Co.
United Cinephone Corp.

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Baird Associates
Builders Iron Foundry
Cambridge Inst. Co.
Geophysical Inst. Co.
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Glogau & Co.
G. M. Mfg. Co., Inc.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Speidel & Co.
Spencer Lens Co.
Testrite Instrument Co.
Warren-Knight Co.
Weber Co., F.
Zeiss, Inc., Carl

MALT TESTING APPARATUS (See Testers, Malt)

MANOMETERS, High Pressure
Daniel Orifice Fitting

MANOMETERS, Inclined Tube
American Blower Corp.
Bacharach Industrial Inst.
Bailey Meter Co.
Consol. Ashcroft Hancock
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Friez & Sons
Fuess, Inc.
Hays Corp.
H-B Inst. Co., Inc.
Meriam Co.
Precision Therm. & Inst.
Uehling Inst. Co.

MANOMETERS, Micro
Bacharach Industrial Inst.
Cambridge Inst. Co.
Fuess, Inc.
Welch Mfg. Co.

MANOMETERS, Remote-reading
Bailey Meter Co.
Brown Inst. Co.
Uehling Inst. Co.

MANOMETERS, Single-tube & Reservoir
Ace Glass Inc.
Bacharach Industrial Inst.
Bailey Meter Co.
Commercial Engg. Labs.
Connelly Iron Sponge Co.
Defender Automatic Reg.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Friez & Sons, Julien
Gas Appliance Specialties
Lantz-Phelps Corp.
Meriam Co.
Morey & Jones, Ltd.
Precision Therm. & Inst.
Scientific Inst. Co.
Simplex Valve & Meter
Uehling Inst. Co.

MANOMETERS, U-tube, Electric Transmitting
Brown Inst. Co.
Bailey Meter Co.
Precision Therm. & Inst.
Southw'n Electronics Labs.

MANOMETERS, U-tube, Glass
Ace Glass, Inc.
Annis Co.
Bacharach Industrial Inst.
Builders Iron Foundry
Connelly Iron Sponge
Consol. Ashcroft Hancock
Defender Automatic Reg.
Detroit Air Meter Co.
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Sargent & Co.
Scientific Inst. Co.
Simplex Valve & Meter
Specialty Glass Co.
Tagliabue Mfg. Co.
Trerice Co.
Uehling Inst. Co.
Vapor Recovery Systems
Wilkens-Anderson Co.

MANOMETERS, U-tube, Metal
Cambridge Inst. Co.
Connelly Iron Sponge
Mason-Neilan Regulator
Precision Therm. & Inst.
Scientific Inst. Co.
Taylor Inst. Cos.

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Spencer Lens Co.

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MARINE INSTRUMENTS, Gyro-Compass & Gyro-Pilot
Sperry Gyroscope Co.

MASTER CLOCKS (See Clocks, Master)

MEASURING MACHINES, Lineal
Bausch & Lomb Opt.
Durant Mfg. Co.
Ferner Co.
Fidelity Mach. Co.
Gaertner Scientific Corp.
Pratt & Whitney

MEASURING MACHINES, Wire
Durant Mfg. Co.
Minneapolis Elec. & Const.
Pratt & Whitney

MEGOHMMETERS
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Cambridge Inst. Co.
Clough-Brengle Co.
General Elec. Co.
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Ill. Testing Labs.
Industrial Instruments
Martindale Electric Co.
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RCA Manufacturing Co.
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American Inst. Co.
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Eimer & Amend
Ferner Co.
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Humboldt Mfg. Co.
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Microchemical Service
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Precision Scientific Co.
Scientific Glass Apparatus
Tagliabue Mfg. Co.
Western Machinery Co.

METAL DETECTORS (See Detectors, Metal)

METALLIC BELLOWS (See Bellows, Metallic)

METALS, Thermostatic
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General Plate

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American Inst. Co.
Am. Paulin System
Friez & Sons
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Green, Henry J.
Moeller Instrument Co.
Precision Therm. & Inst.
Taylor Inst. Cos.
Weksler Thermometer

METER LEVELING SADDLES
Robinson Orifice Fitting

METER PROVERS, Gas
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Lambert Meter Co.
Pgh. Equitable Meter Co.

METER STICKS
Lufkin Rule Co.
Weber Co.

METERS, Acid (See Acidimeters)

METERS, Ampere Hour (See Ampere Hour Meters)

METERS, Coal (See Coal Meters)

METERS, Compressed Air
American Meter Co.
Bailey Meter Co.
Mason-Neilan Regulator
N. J. Meter
Taylor Inst. Cos.

METERS, Condensation
Am. Dist. Steam Co.
Bailey Meter Co.
Buffalo Meter Co.
Central Station Steam
Henszey Co.
Taylor Inst. Cos.

METERS, Conductivity (See Conductivity Meters)

METERS, Consumer's, Electric
General Elec. Co.
Westinghouse Elec. & Mfg.

METERS, Consumer's, Gas
American Meter Co.
Lambert Meter Co., Inc.

METERS, Current, Air & Gas
American Meter Co.
Mason-Neilan Regulator
Pgh. Equitable Meter Co.

METERS, Current, Liquid
American Meter Co.
Bowser & Co.
Builders Iron Foundry
Eclipse Aviation
Keuffel & Esser Co.
Mason-Neilan Regulator
National Meter Co.
Neptune Meter Co.
Pgh. Equitable Meter Co.
Scientific Inst. Co. (Calif.)
Uehling Instrument Co.
Worthington-Gamon Meter

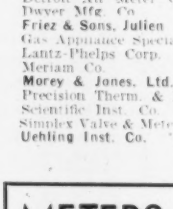
METERS, Decibel (See Sound Level Meters)

METERS, Demand, Electric
Electric Indicator Co.
Esterline-Angus Co.
General Elec. Co.
HD Elec. Co.
Landis & Gyr, Inc.
Lincoln Meter Co.
Sangamo Electric Co.
Therm-Electric Meters
Westinghouse Elec. & Mfg.

METERS, DEMAND, Gas
American Meter Co.
Bailey Meter Co.
Bendix Marine Products
Lambert Meter Co.
Mason-Neilan Regulator
Pgh. Equitable Meter Co.

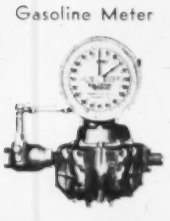
METERS *for* GAS—WATER—OIL—GASOLINE

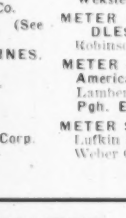
GAS PRESSURE REGULATORS



Pittsburgh Water Meter

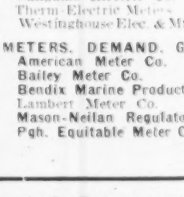
Pittsburgh Piston Gasoline Meter





EMCO Domestic Gas Meter

EMCO Orifice Meter



EMCO Ejector Gas Service Regulator

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Trimount Direct Reading "U" type manometer

Here's precision built "U" type manometer that gives instantaneous readings with the flick of the wrist. Scale reads *direct* in inches and tenths—no addition of liquid levels needed. Saves time—eliminates errors. Operates on simple, unique sliding scale principle. Made in wide range of standard sizes from 15" to 100" for all pressures for use with mercury, oil or water. Cost very little more than ordinary fixed scale manometers. Write for catalog B-2.

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Cambridge Inst. Co.
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METERS, Water (See Liquid Meters, Volumetric; also Flowmeters, Liquid)

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Pittsburgh Inst. & Mach.
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For addresses, see pages 66-76.

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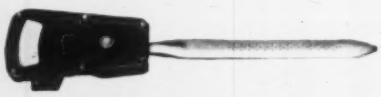

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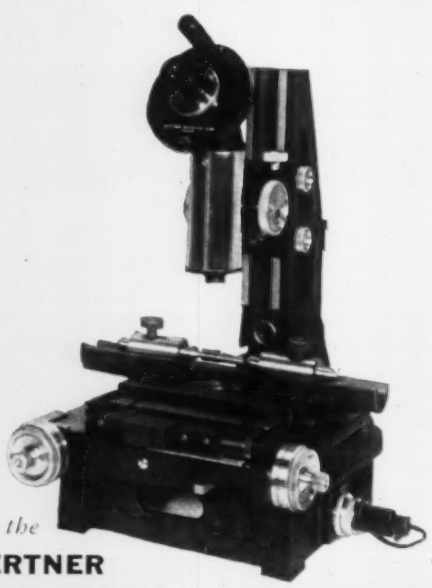

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Heating Capacity—750 Watts
Operating Current—110 volts, 60 cycles, AC (25 cycles or DC if required)

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Brabender Corporation Rochelle Park, New Jersey

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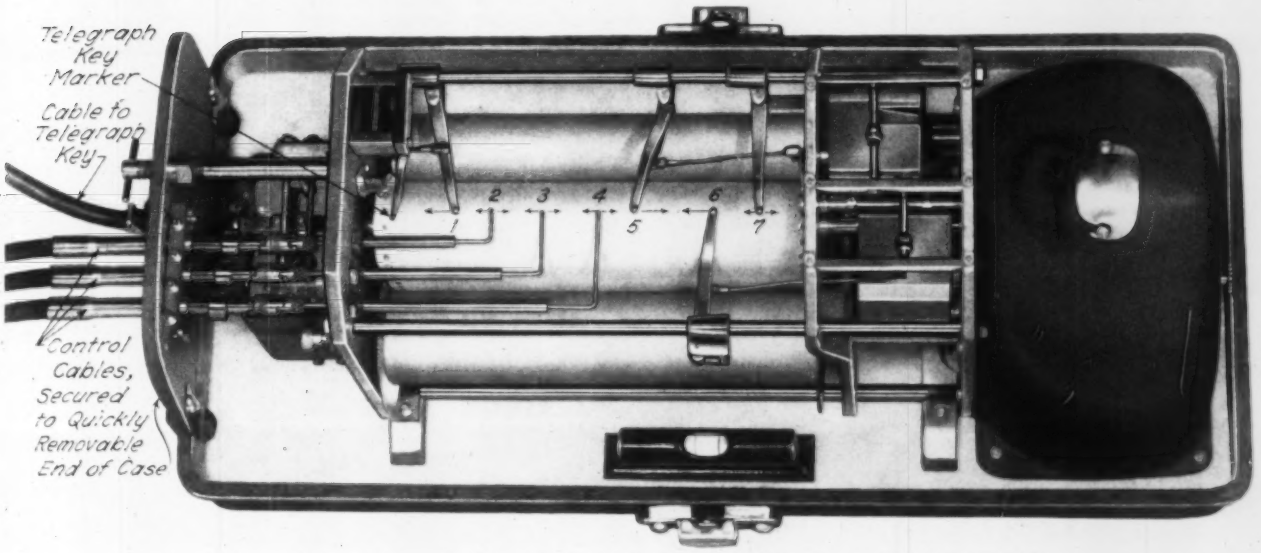
THE R-S AIRPLANE ATTITUDE AND CONTROLS MOVEMENT RECORDER

Automatically records on a wax-coated chart:

1-Acceleration Toward Base	2-Elevator Up-Down	3-Ailerons Right-Left	4-Rudder Right-Left	Lateral Attitude: 5-Left Wing Low	Lateral Attitude: 6-Right Wing Low	7-Longitudinal Pitch Up-Down
				(In either straight or curved flight.)		



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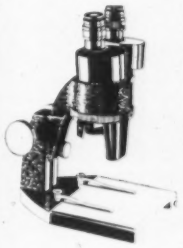
Spencer Instruments for Industrial Control



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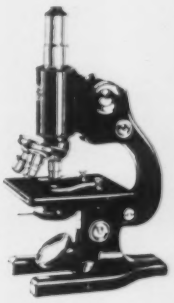

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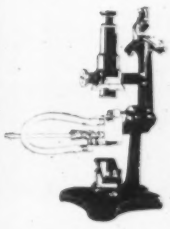
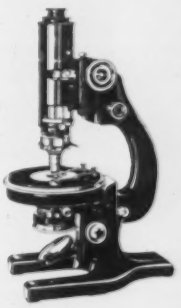


The Spencer Refractometer provides a quick and accurate method for determining the refractive indices of liquids and solids.



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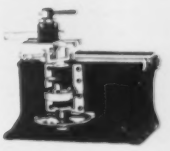
Direct Result COLORIMETER is used wherever characteristic color is produced proportional in intensity to the concentration of a substance in solution.

The Spencer Microtomes are used for cutting cross-sections of material for microscopic examination of structure, results of processing, etc.

Write Dept. No. N32 for catalogs describing these instruments more completely.



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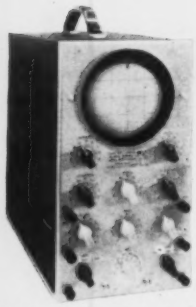

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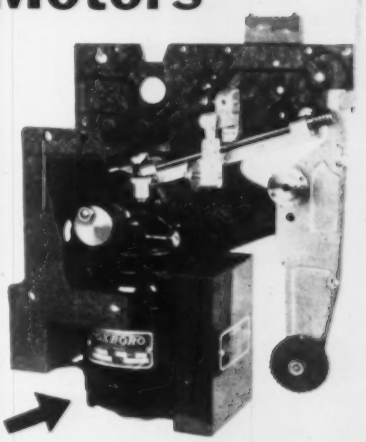

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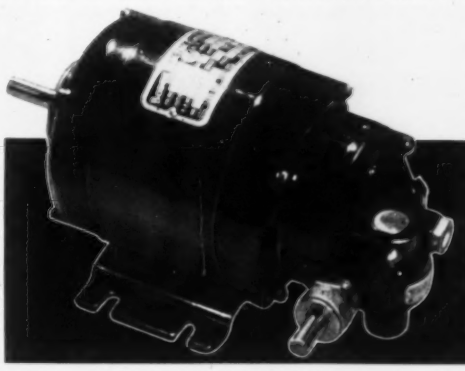

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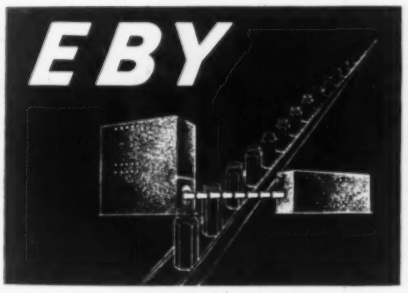

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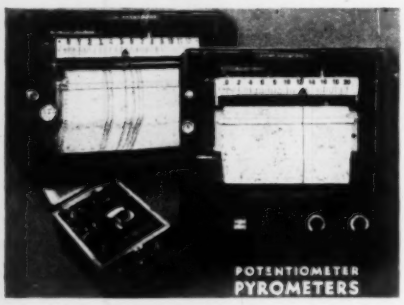

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Trill Indicator Co.

PLANIMETERS, Square Root
Bailey Meter Co.
Foxboro Co.
Henschel & Co.
Keuffel & Esser Co.
Speidel & Co.
Taylor Inst. Cos.

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Brown & Sharpe
Dietzen Co.
Gurley, W. & L. E.
Keuffel & Esser Co.
Millers Falls Co.
Post Co., Frederick
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Soltmann, Inc.
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Starrett Co.
Ulmer Co., J. C.
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Weber Co.
White Co. Inc.

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Central Scientific Co.
Gaertner Scientific Corp.
Jarrell-Ash Co.
Kern Co.
Leitz, Inc.
Pfaltz & Bauer, Inc.
Sargent & Co.
Zeiss, Inc., Carl

POLARISCOPE TUBES (See Tubes, Polariscope)

POLARISCOPES
Akatos, Inc.
Bausch & Lomb Opt.
Gaertner Scientific Corp.
Jarrell-Ash Co.
Pfaltz & Bauer, Inc.
Welch Mfg. Co.

POLARISCOPES, Photoelasticity
Bausch & Lomb Optical
Central Scientific Co.
Fecker, J. W.
Fuess, Inc.
Gaertner Scientific Corp.
Jarrell-Ash Co.
Kollmorgen Optical Co.
Polarized Light & Photo.
Polarizing Instrument
Precision Therm. & Inst.
Woermann-Schuchhardt
Xervac Inst. Co.
Zeiss, Inc., Carl

POLARITY INDICATORS
Ruehfel Co.
Weston Elec. Inst. Corp.

POLARIZING PLATES
Central Scientific Co.
Fuess, Inc.
Polarized Products
Polarizing Instrument
Woermann-Schuchhardt
Zeiss, Inc., Carl

POLISHING MACHINES
American Inst. Co.
Eimer & Amend
Fisher Scientific Co.
Mico Instrument Co.

POLYGRAPH
Associated Research

PORCELAIN, Laboratory
Akatos, Inc.
Coors Porcelain Co.
Fish-Schurmann Co.

POROUS WARE FOR ELECTROLYSIS
Coors Porcelain Co.
Fish-Schurman Co.

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Bendix Marine Products
Boston Auto Gage Co.
Builders Iron Foundry
Elec. Indicator Corp.
Electric Speed Ind.
Elec. Tachometer Corp.
Foxboro Co.
General Elec. Co.
Hickok Elec. Inst. Co.
Pioneer Instrument Co.
Shallcross Mfg. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

POSITION RECORDERS
Amer. Automatic Electric
Annis Co.
Autocall Co.
Bailey Meter Co.
Builders Iron Foundry
Elec. Indicator Corp.
Elec. Tachometer Corp.
Foxboro Co.
Westinghouse Elec. & Mfg.

POSTS, BINDING (See Connectors)

POTENTIAL DETECTORS (See Detectors, Potential)

POTENTIOMETERS, Automatic Control
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Coleman Elec. Co.
Dickson Co.
Foxboro Co.
Leeds & Northrup Co.

POTENTIOMETERS, Automatic Control (Cont'd)
Lewis Engg. Co.
Mason Neilan Regulator
Spence Engineering Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wheelco Inst. Co.

POTENTIOMETERS, Automatic Self Balancing
Bailey Meter Co.
Bristol Co.
Electronic Prod. Co.
Foxboro Co.
Leeds & Northrup Co. (Cont'd)

POTENTIOMETERS Automatic Self Balancing (Continued)
Lewis Engg. Co.
Tagliabue Mfg. Co.
Weston Elec. Inst. Corp.

POTENTIOMETERS, Indicating
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Dickson Co.
Foxboro Co.
General Elec. Co.
Hellige, Inc.
J-B-T Insts., Inc.
Leeds & Northrup Co.
Lewis Engg. Co.
Remler Co., Ltd.
Rubicon Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument
Wheelco Inst. Co.
Weston Elec. Inst. Corp.

POTENTIOMETERS, Recording
American Inst. Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Clarostat Mfg. Co.
Foxboro Co.
Leeds & Northrup Co.
Lewis Engg. Co.
Mason Neilan Regulator
Tagliabue Mfg. Co.
Thwing-Albert Instrument
United Cinephone Corp.

POWDERED MATERIALS MEASUREMENTS (See Granular Materials)

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General Elec. Co.
Hickok Elec. Inst. Co.
Leeds & Northrup Co.
Roller-Smith Co.
Sensitive Research Inst.
Westinghouse Elec. & Mfg.

POWER FACTOR RECORDERS
Elec. Facilities Inc.
Esterline-Angus Co.
General Elec. Co.
Leeds & Northrup Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg.

POWER FACTOR REGULATORS
Allis-Chalmers Mfg.
Leeds & Northrup Co.
Vaughn-G. E. Witt Co.

POWER-LEVEL INDICATORS
Clough-Brengle Co.
General Elec. Co.
General Radio Co.
Hickok Elec. Inst. Co.
Shallcross Mfg. Co.
Sound Apparatus Co.
Westinghouse Elec. & Mfg.

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Fischer & Porter
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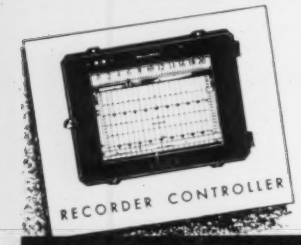

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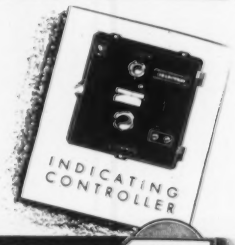

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Eimer & Amend
Hydraulic Press Co.
Microchemical Service
Williams Apparatus
PRESSES, PELLET
Central Scientific Co.
Eimer & Amend
Hannifin Mfg. Co.
Parr Instrument Co.
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PRESSURE, High (Above 1000 lbs.) Indicators
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Arca Regulators, Inc.
Atlas Valve Co.
Bailey Meter Co.
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Brooke Eng. Co.
Brown Inst. Co.
Crosby Steam Gage Co.
Fisher Governor Co.
Foxboro Co.
Heise Bourdon Tube Co.
Kollsman Inst. Co.
Kurman Electric Co.
Linde Air Products Co.
Marsh Corp.
Mason Neilan Regulator
McAlear Mfg. Co.
RCA Manufacturing Co.
Republic Flow Meters
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Trerice Co.
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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Cash Co.
Commercial Engg. Labs.
(Cont'd)

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Dickson Co.
Esterline-Angus Co.
Foxboro Co.
Hydraulic Press Co.
Kurman Electric Co.
Linde Air Products Co.
Marsh Corp.
Mason-Neilan Regulator
Republic Flow Meters Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
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Foxboro Co.
Kurman Electric Co.
Parr Instrument Co.
Pioneer Instrument
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Refinery Supply Co.
Walter Ruska & Co., Inc.
Star Brass Mfg. Co.
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Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Crosby Steam Gage Co.
Defender Automatic Reg.
Dickson Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Pioneer Instrument
Precision Therm. & Inst.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
PRESSURE INDICATORS, Bourdon-tube
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Baldwin-Southwark Corp.
Bristol Co.
Brown Inst. Co.
Crosby Steam Gage Co.
Dickson Co.
(Cont'd)

PRESSURE INDICATORS, Bourdon-tube (Cont'd)
Foxboro Co.
Heise Bourdon Tube Co.
Hoke, Inc.
Kenyon Instrument Co.
Kollsman Inst. Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Pioneer Instrument
Republic Flow Meters
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
PRESSURE INDICATORS, Diaphragm, etc.
Abercrombie Pump Co.
Bailey Meter Co.
Brown Inst. Co.
Dickson Co.
Foxboro Co.
King-Seeley Corp.
Kollsman Inst. Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Pioneer Instrument
Powers Regulator Co.
Rochester Mfg. Co.
Tagliabue Mfg. Co.
PRESSURE INDICATORS, Electrical-resistance
Baldwin-Southwark Corp.
General Elec. Co.
Kurman Electric Co.
Rubicon Co.
PRESSURE INDICATORS, Inverted-bell
Bacharach Indus. Inst.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Dickson Co.
Foxboro Co.
Mason-Neilan Regulator
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Uehling Inst. Co.
PRESSURE INDICATORS, Membrane
Bailey Meter Co.
(Cont'd)

PRESSURE INDICATORS, Membrane (Cont'd)
Dickson Co.
Mason-Neilan Regulator
PRESSURE INDICATORS, Piezoelectric
Batcher, Ralph R.
Brush Development Co.
Commercial Engg. Labs.
RCA Manufacturing Co.
PRESSURE INDICATORS, Piston, Weight-loaded
American Inst. Co.
Bailey Meter Co.
Hagan Corp.
Pioneer Instrument
PRESSURE INDICATORS, Single-tube, liquid column
Bacharach Indus. Inst.
Detroit Air Meter Co.
Dwyer Mfg. Co.
Gas App. Specialties
Morey & Jones, Ltd.
Pioneer Instrument
Precision Therm. & Inst.
Uehling Instrument Co.
PRESSURE INDICATORS, Spring-loaded piston
Bacharach Indus. Inst.
Commercial Engg. Labs.
PRESSURE INDICATORS, U-tube
Amthor Test. Mach.
Bacharach Indus. Inst.
Bailey Meter Co.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Detroit Air Meter Co.
Dwyer Mfg. Co.
Friez & Sons
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Gotham Inst. Co.
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Meriam Co.
Moeller Instrument Co.
Morey & Jones, Ltd.
Precision Therm. & Inst.
Refinery Supply Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
Uehling Instrument Co.

PRESSURE RECORDERS, Bellows
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Dickson Co.
Esterline-Angus Co.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.
PRESSURE RECORDERS, Bourdon tube
Bailey Meter Co.
Baldwin-Southwark Corp.
Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
Dickson Co.
Esterline-Angus Co.
Foxboro Co.
Gotham Inst. Co.
Improved Gauge Mfg. Co.
Kenyon Instrument Co.
Leeds & Northrup Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Republic Flow Meters
Star Brass Mfg. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thrush & Co., H. A.
Trerice Co.
PRESSURE RECORDERS, Capsular spring
Tagliabue Mfg. Co.
PRESSURE RECORDERS, Diaphragm
Bailey Meter Co.
Brown Inst. Co.
Foxboro Co.
Dickson Co.
Marsh Corp., Jas. P.
Mason-Neilan Regulator
Morey & Jones, Ltd.
Tagliabue Mfg. Co.
PRESSURE RECORDERS, Electrical-resistance
Republic Flow Meters
PRESSURE RECORDERS, Inverted-bell
Bacharach Indus. Inst.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Dickson Co.
Foxboro Co.
Leeds & Northrup Co.
Mason-Neilan Regulator
Taylor Inst. Cos.
Uehling Instrument Co.
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Mason-Neilan Regulator
PRESSURE RECORDERS, Piezoelectric
Brush Development Co.
RCA Manufacturing Co.
PRESSURE RECORDERS, Piston, weight-loaded
Bailey Meter Co.
PRESSURE RECORDERS, Single-tube liquid column
Trerice Co.
Uehling Instrument Co.
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Baldwin-Southwark Corp.
Commercial Engg. Labs.
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Brown Inst. Co.
Foxboro Co.
Mason-Neilan Regulator
Republic Flow Meters
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.
Uehling Instrument Co.
PRESSURE SNUBBERS
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Marsh Corp.
Martin Decker Corp.
McAlear Mfg. Co.
Meriam Co.
National Engg. Prods.
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Bausch & Lomb Opt.
Clark & Sons
Fish-Schurman Co.
Fecker, J. W.
Fuess, Inc.
Gaertner Scientific Corp.
Goertz Amer. Optical Co.
Jarrell-Ash Co.
Kern Co.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Machlett & Son
Perkin-Elmer Corp.
Rieker Inst. Co.
Spencer Lens Co.
Valpey Crystals
Woermann-Schuchhardt
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PROGRAM CLOCKS (See Timers, Automatic Process)
PROJECTORS, Color Film
Bausch & Lomb Optical
Bell & Howell Co.
Leitz, Inc.
Spencer Lens Co.
Woermann-Schuchhardt
PROJECTORS, Film Slide, Lantern Slide & Opaque Object
Bausch & Lomb Optical
Leitz, Inc.
Spencer Lens Co.
Woermann-Schuchhardt
Zeiss, Inc.
PROTRACTORS, Bevel (See Drawing Instruments)
PROTRACTORS, Course
Alpha Instrument Co.
Bliss & Co.
Eastern Science Co.
Kenyon Instrument Co.
Keuffel & Esser Co.
Marine Compass Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Warren-Knight Co.
PROTRACTORS, Navigators (See Protractors, Course)
PROTRACTORS, Transparent (See Drawing Instruments)
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Lambert Meter Co., Inc.
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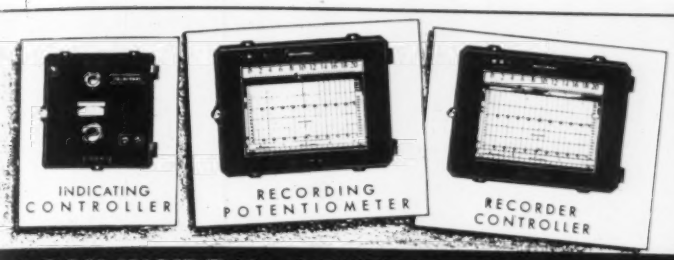

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Pittsburgh Inst. & Mach.

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Electro-Medical Lab.
General Radio Co.
Phipps & Bird, Inc.

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Brown Inst. Co.
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
H-B Inst. Co., Inc.
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Moeller Instrument Co.
Palmer Co.

PSYCHROMETERS, Atomizing
Parks-Cramer Co.

PSYCHROMETERS, Electric (See Psychrometers, Aspiration)

PSYCHROMETERS, Recording
(See Hygrometers, Recording)

PSYCHROMETERS, Sling
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American Inst. Co.
American Moistening Co.
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(Cont'd)

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Fried & Lustig
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
Green, Henry J.
H-B Inst. Co., Inc.
Huddleston, J. S. F.
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Moeller Instrument Co.
Palmer Co.
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Taylor Inst. Cos.
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Rieker Inst. Co.
Rubicon Co.
Scientific Glass App.
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Chicago Apparatus Co.
Distillation Prods., Inc.
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Cambridge Inst. Co.
Dickson Co.
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Lewis Engg. Co.
Roller-Smith Co.
Rubicon Co.
Tagliabue Mfg. Co.
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Wheelco Inst. Co.

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Defender Automatic Reg.
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Partlow Corp.
Tagliabue Mfg. Co.

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Bristol Co.
Brown Inst. Co.
Burling Inst. Co.
Electronic Prod. Co.
Elematic Mfg. Co.
Engelhard, Chas.
Foxboro Co.
Ill. Testing Labs.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Inst. Co.
Roller-Smith Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Brown Inst. Co.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Elematic Mfg. Co.
Engelhard, Chas.
Foxboro Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
Pyrometer Instrument Co.
Rubicon Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Brown Inst. Co.
Burrell Technical Supply
Cambridge Inst. Co.
Fisher Scientific Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.

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Burrell Technical Supply
Cambridge Inst. Co.
Elematic Mfg. Co.
Engelhard, Chas.
Foxboro Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
J-B-T Instruments
Leeds & Northrup Co.
Lewis Engg. Co.
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Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Brown Inst. Co.
Cambridge Inst. Co.
Dickson Co.
Foxboro Co.
J-B-T Insts., Inc.
Leeds & Northrup Co.
Lewis Engg. Co.
Rubicon Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument
Wheelco Inst. Co.

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Brown Inst. Co.
Cambridge Inst. Co.
Engelhard, Chas.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup Co.
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Thwing-Albert Instrument
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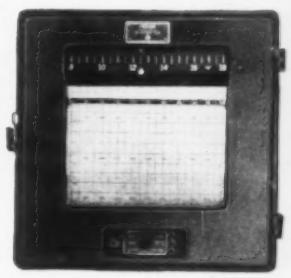
J-B-T INDICATING PYROMETERS

- RUGGED, ACCURATE
- MANY SIZES, RANGES, INCLUDING 3" PANEL
- THERMOELECTRIC, OR POTENTIOMETRIC; ALSO RESISTANCE TYPE

Model 70-PO potentiometer-pyrometer (portable model illustrated—also wall mounted) combines potentiometer accuracy with ease of reading deflection instrument. Eliminates balancing, is read faster. Write for literature, suggesting application.

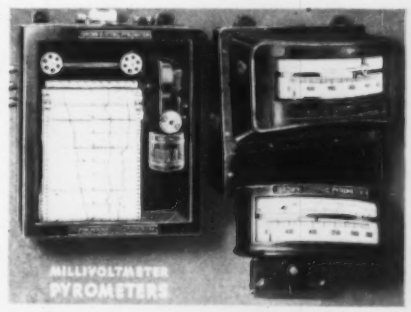
J-B-T INSTRUMENTS, Inc.
441-G CHAPEL ST. NEW HAVEN, CONN.

FOXBORO
PYROMETERS



The Foxboro Pyrometer line embraces a variety of types including Indicators, Controllers and Recorder Controllers. Single and multiple recording instruments up to eight records on one chart are available. The Recorder-Controller is made in several types, both air- and electrically-operated, to fill practically every conceivable need.

For complete information write for Bulletin No. 190-4. **The Foxboro Company, 46 Neponset Avenue, Foxboro, Massachusetts, U. S. A.** Branch offices in principal cities of the United States and Canada.



For Controlling, Recording and Indicating Temperatures from 0 to 3000° F.

A direct-reading, simple and sturdy pyrometer, especially suited for industrial applications where simplicity and ruggedness are of greater importance than extreme accuracy. The instrument can be calibrated to compensate for long lengths of extension lead wire between thermocouples and instrument. No dry cells or standard cells required.

Charts and scales for a wide variety of ranges are available, from a minimum temperature span of 800° F. to a maximum span of 3000° F. Corresponding Centigrade scales and charts are also available.

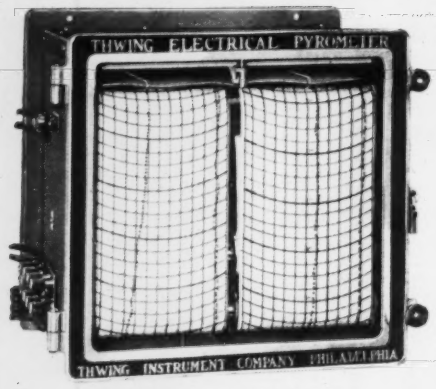
Pyrometer accessories, such as thermocouples and extension lead wire, furnished with instruments to meet the requirements of each job.

Write for Catalog 15-E, THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4482 Wayne Avenue, Philadelphia, Pa.

BROWN PYROMETERS
AND
MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS
To Measure and Control is to Economize

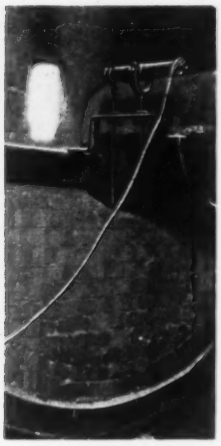
For addresses, see pages 66-76

THWING-ALBERT Plant

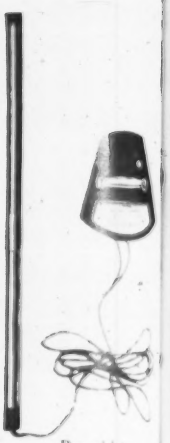


Multiple Recording Pyrometer

Indicating Pyrometer combined with Selector Switch



Radiation Pyrometer for Rotary Kiln



Portable Radiation Pyrometer

Treasure Chest Potentiometer. Pyrometer and Thermocouple Testing Set.

A5X Pyrometer for molten non-ferrous metals

TEMPERATURE MEASURING, CONTROL AND TESTING INSTRUMENTS

RECORDING PYROMETERS: Single record and multiple recording types. Continuous roll charts. Automatic chart re-roll. Patented dot and dash system of recording. Synchronous electric motor drive. Metal case construction. Accurate, simplified and rugged.

Furnished for use with either base metal or platinum thermocouples, radiation pyrometer receiving tubes or electrical resistance thermometer bulbs.

INDICATING PYROMETERS: Single indicating type or multiple point indicating type. Model 30 Pyrometer, illustrated, unit construction. Indicating Pyrometer and selector switch contained in a single moisture, fume and dust-proof metal case. Furnished with switch capacities 4, 6, 8, 12, 16, 24 and 32 points and off position. Suitable especially for diesel engine service, ceramic plants, etc.

RADIATION PYROMETERS: For indicating and recording all high temperatures. No part of pyrometer installed in the heat source. Accurate to the highest temperatures. Radiation receiving tubes are designed and manufactured for permanent installation. Suitable especially for the lime, cement, refractories, glass and steel industries. Portable radiation pyrometer applicable for various service. Temperature readings in 15 seconds.

FOUNDRY PYROMETERS: For nonferrous metals; A5X Pyrometer with extensible magazine thermocouple. Junctions made by twisting wires together tightly. Temperature readings in 8 seconds.

For ferrous metals; A5F Pyrometer with protected, replaceable thermocouple. Temperature readings in one minute.

PYROMETER TESTING SET: Treasure Chest, a two point portable potentiometer and a pyrometer and thermocouple testing set combined in the one instrument.

Self checking with Electrocrit checking circuit. Range 101 millivolts. Accuracy 1/10 of one percent. Checks all types and all makes of pyrometers and thermocouples.

THERMOCOUPLES: Base Metal and Noble Metal (Platinum, platinum-rhodium).

Furnished with protection tubes to suit individual installation conditions.

AUTOMATIC TEMPERATURE CONTROLLER: Controls automatically and accurately industrial temperature processes. Furnished for operation in conjunction with recording and indicating pyrometers. Applicable to oil, gas and electrically heated furnaces.

PORTABLE pH METERS: Range 0 to 14 pH. Direct reading in pH units.

Model 1 — Simple potentiometric circuit using quinhydrone or antimony electrode.

Model 2 — Vacuum tube potentiometer circuit using glass electrodes and/or quinhydrone and antimony electrodes.

Model 3 — Standard cell balance, slide wire type. Vacuum tube, continuous deflection potentiometric circuit. Can be used with every type of electrode. Direct reading in millivolts and pH units.

Automatic Temperature Controller

Portable pH Meter

Thwing-Albe

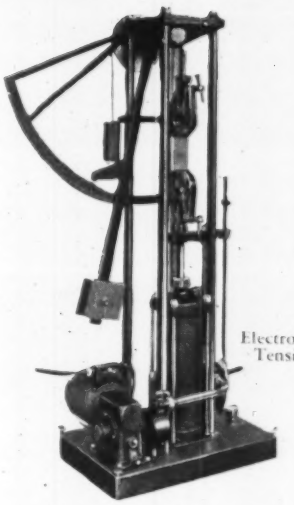
Manufacturers of Scie

3323 LANCASTER AVE

Commercial h

Catalogs Available on Complet

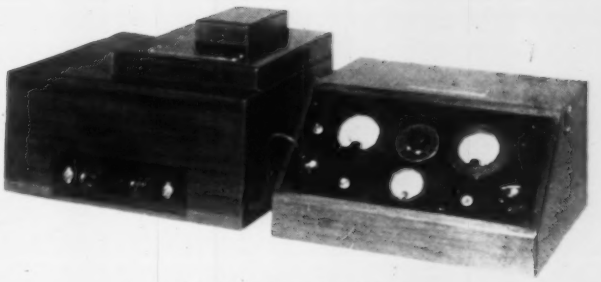
Laboratory Instruments



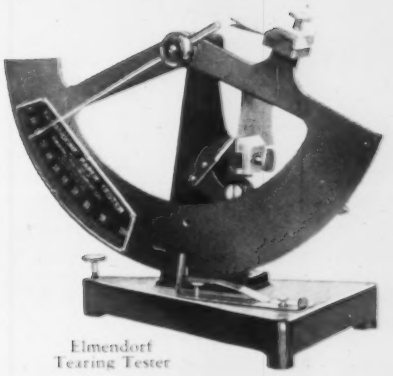
Platinum Thermo-couple

Electro Hydraulic Tensile Tester

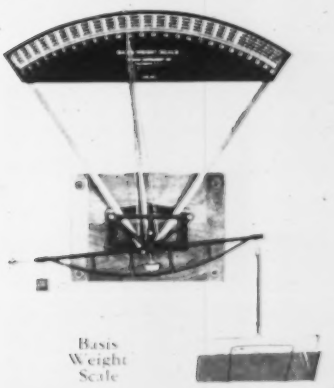
Research Tearing Tester



Formation Tester for Paper



Elmendorf Tearing Tester



Basis Weight Scale

ELECTRO-HYDRAULIC TENSILE TESTER: For testing paper, textiles, fine wire, single thread, skein yarn, card board, ply wood, etc. Tensile and elongation tests made to conform with A.S.T.M. and T.A.P.P.I. official testing methods. Operated by electro-hydraulic power. Completely self-contained. Can be furnished with graphic recording device to record tensile stress and elongation of individual specimens.

PAPER TESTING INSTRUMENTS.

ELMENDORF TEARING TESTER: Determines tearing strength of paper and allied products, textile fabrics, cinema film, etc. Operates by gravity. Gives readings in force grams required to tear materials. Standard tearing tester of paper industry.

Two in One Feature: Augmenting Attachment available that doubles capacity of Elmendorf Tester and makes two instruments in one. Permits testing heavy grade papers, felts, etc.

RESEARCH TEARING TESTER: For research and exploratory testing of materials where sensitivity desired is finer than calibration of the standard Elmendorf Tearing Tester.

INITIAL TEAR TESTER (not illustrated): Measures the initial force required to start a tear. Direct reading, resistance to beginning of tear is indicated in force pounds. Especially suitable for testing box board, roofing felts, floor coverings, gasket papers, etc.

BASIS WEIGHT SCALES: Aristocrat Model and Desk Type.

Basis Weight Scales read directly weight per ream of paper by weighing a single sheet. Furnished with ranges to suit individual requirements. Useable for moisture content determinations.

BOX BOARD SCALES: A combination basis-weight and sheet counting scale. Indicates on a single dial weight per ream and sheets per bundle.

PENETRATION TESTER: The Penescope provides visual method of testing papers and other materials for permeability to solutions.

Also, Water Jacketed Penescope with equipment to make penetration tests under controlled temperature conditions.

VAPOR TRANSMISSION TESTER: The Vapometer, a simple convenient instrument for testing the vapor transmission properties of paper.

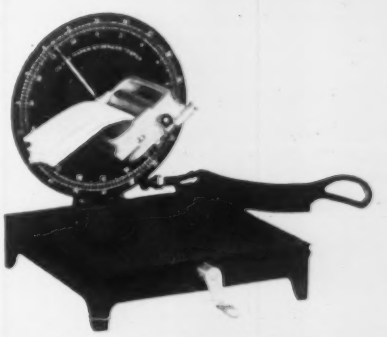
STIFFNESS-SOFTNESS TESTER: Determines stiffness or softness properties by the flexibility of paper in a predetermined angle of rotation.

Research Tester has rollers to adjust length of specimen.

Routine Tester has snap clamp for tests on specimens of known length.

FORMATION TESTER: Measures objectively the property of paper known as Formation. Test specimen in scanning mechanism is moved at high velocity between photo electric cell and light source.

Variations in paper structure (formation) determined electrically. Reading on meter gives formation number. Constructed ruggedly. Simple to operate.



Stiffness-Softness Tester for Paper

Desk Type Basis Weight Scale

Penescope

Vapometer

strument Co.

ruments for 39 Years

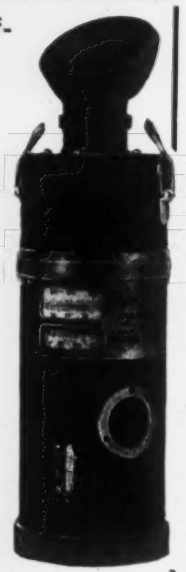
PHILADELPHIA, U. S. A.

tory Accuracy

and Paper Testing Instruments

PYRO THE SIMPLIFIED OPTICAL PYROMETER

YOU cannot afford NOT to own one!



Because it eliminates guesswork, waste and spoilage; it pays for itself quickly. PYRO is a SELF-CONTAINED DIRECT - READING, STURDY unit made to stand rough use but it is absolutely accurate and dependable.

Unique construction enables operator to rapidly determine temperature even on minute spots, fast moving objects or the smallest streams; no correction charts, no accessories, no upkeep.

Stock Ranges: 1400° to 5500° F.

PYRO RADIATION PYROMETER

Ideal for furnace or kiln use. Gives actual heat of material

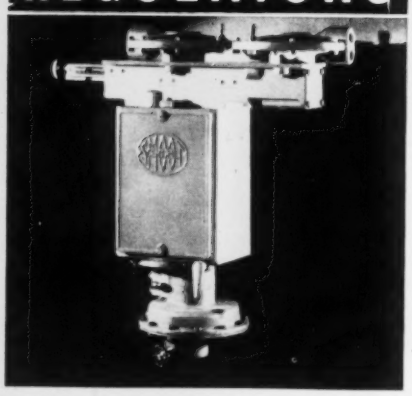
aside from furnace or kiln temperature. Does not require skilled operator. Stock ranges 1000° to 3600° F.

Write for special bulletins

THE PYROMETER INSTRUMENT CO.

103 107 LAFAYETTE ST., NEW YORK, N. Y.
311 ROSS ST., PITTSBURGH, PA.

REGULATORS



Republic-Smoot regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.

Republic-Smoot regulators may be either oil or air operated. Their extreme flexibility in application and the degree to which they meet the four requirements of sensitivity, power, speed and stability, had been responsible to a large degree for the outstanding success of Republic-Smoot control systems.

WRITE FOR DATA BOOK No. S-13

REPUBLIC FLOW METERS CO.
2249 DIVERSEY PKWY., CHICAGO, ILLINOIS

PYROMETERS, Radiation, Indicating
Bachrach Industrial Inst.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
General Elec. Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Wheelco Inst. Co.

PYROMETERS, Radiation, Recording
Bachrach Industrial Inst.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
General Elec. Co.
Leeds & Northrup Co.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument

PYROMETERS, Thermoelectric, Immersion
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Elematic Mfg. Co.
General Elec. Co.
Ill. Testing Labs.
J-B-T Insts., Inc.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Inst. Co.
Roller-Smith Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument
Woermann-Schuchhardt

PYROMETERS, Thermoelectric, Indicating
Am. Gas Furnace Co.
Bailey Meter Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Elematic Mfg. Co.
Foxboro Co.
Hebler Co.
Hoskins Mfg. Co.
Ill. Testing Labs.
J-B-T Insts., Inc.
Leeds & Northrup Co.
Lewis Engg. Co.
Partlow Corp.
Pyrometer Instrument Co.
Roller-Smith Co.
Rubicon Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument
Western Instrument Co.
Wheelco Inst. Co.

PYROMETERS, Thermoelectric, Recording & Controlling
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Bailey Meter Co.
Beck Co.
Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Engelhard, Chas.
Foxboro Co.
General Elec. Co.
Ill. Testing Labs.
Leeds & Northrup
Lewis Engg. Co.
Mason-Neilan Regulator
Partlow Corp.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Thwing-Albert Instrument

PYROMETERS, Thermoelectric, Surface Contact
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Bristol Co.
Brown Inst. Co.
Cambridge Inst. Co.
Elematic Mfg. Co.
Foxboro Co.
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Ill. Testing Labs.
J-B-T Instruments
Lewis Engg. Co.
Pyrometer Instrument Co.
Tagliabue Mfg. Co.
Thwing-Albert Instrument

PYROMETRIC CONES (See Cones, Pyrometric)

QUARTZ, Fused Quartz Apparatus
Hanovia Chem. & Mfg.
Thermal Syndicate Ltd.

RACKS, STEEL, For Capacitors, Resistors, Transformers, etc.
Falstrom Co.

RADIO BEACON SYNCHRONIZING CONTROLLERS
Andrew, Victor J.
United Cinephone Corp.
Wallace & Tiernan

RADIO FREQUENCY METERS
Andrew, Victor J.
Clough-Brengle Co.
Ferris Inst. Corp.
General Elec. Co.
Hickok Elec. Inst. Co.
Lampkin Laboratories
Measurement Corp.

(Cont'd)

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Rawson Electrical Inst.
RCA Manufacturing Co.
Roller-Smith Co.
Sensitive Research Inst.
Simpson Elec. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

RADIO FREQUENCY OSCILLATORS (See Oscillators, Radio Frequency)

RADIO-MICROMETERS (See Micrometers, Radio)

RADIO REMOTE CONTROL SYSTEMS
American Automatic Elec.
McFarlin Co.
Pioneer Instrument
RCA Manufacturing Co.
United Cinephone Corp.
Wallace & Tiernan

RADIO SET ANALYZERS (See Analyzers, Radio Set)

RADIO TEST PANELS (See Panels, Radio Test)

RADIO TUBE CHECKERS (See Checkers, Radio Tube)

RAIN GAGES
Ballauf Mfg. Co.
Central Scientific Co.
Friez & Sons
Fuess, Inc.
Green, Henry J.
Gurley, W. & L. E.
Keuffel & Esser Co.
Leupold, Volpel & Co.
Precision Therm. & Inst.
Taylor Inst. Cos.
Warren-Knight Co.
White Co., Inc.

RAINFALL RECORDERS
Esterline-Angus Co.
Friez & Sons
Fuess, Inc.
Green, Henry J.
Leupold, Volpel & Co.
Taylor Inst. Cos.

RANGE FINDING INSTRUMENTS
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Keuffel & Esser Co.
Kollmorgen Optical Co.
Leitz, Inc.
Precision Therm. & Inst.
White Co., Inc.

RANGE POLES (See Surveying Instruments)

REACTANCE METERS
Andrew, Victor J.
General Radio Co.
Premier Crystal Labs.
Rubicon Co.

READING LENSES, Thermometer & Burette (See Lenses, Reading)

RECORDERS (See object of measurement and control)

RECORDERS, SOUND
Miles Reproducer Co.

RECTIFIERS, Dry Disc
Am. Automatic Electric
Benwood Linze Co.
Elec. Facilities, Inc.
General Elec. Co.
Mellaphone Corp.
Raytheon Mfg. Co.
Standard Elec. Time
United Transformer Corp.

RECTIFIERS, Power
Allis-Chalmers Mfg.
Applied Research Labs.
Eclipse Aviation
Elec. Facilities, Inc.
Electro Products Labs.
General Elec. Co.
Mellaphone Corp.
Raytheon Mfg. Co.
United Transformer Corp.

RECTIFIERS, Thermionic
American Automatic Elec.
Andrew, Victor J.
Continental Elec. Co.
DuMont Labs., Inc., A.B.
Electro Products Labs.
Electrons, Inc.
General Elec. Co.
Hy-Ef Elec. Products
Jones-Ormo Co.
Mellaphone Corp.
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RCA Manufacturing Co.
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United Transformer Corp.

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Crosby Steam Gage Co.
Robertson, 3rd. J. L.
Trill Indicator Co.

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Luxtrol Co., Inc.
Pfaltz & Bauer, Inc.
Woermann-Schuchhardt

REFLECTOMETERS
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American Inst. Co.
Higgins, Charles F.
Leeds & Northrup Co.
Woermann-Schuchhardt

REFLECTORS, Aspheric
Am. Telescope Labs.
Baird Associates
Bausch & Lomb Optical
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.

REFLECTORS, Concave
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.
Tinsley Labs.

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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.
Tinsley Labs.

REFLECTORS, Heat Resisting
Am. Telescope Labs.
Bausch & Lomb Optical
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.

REFLECTORS, Parabolic
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.
Tinsley Labs.
Weber Bros. Metal Works

REFLECTORS, Spherical
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Baird Associates
Bausch & Lomb Optical
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Fuess, Inc.
Perkin-Elmer Corp.
Tinsley Labs.

REFLECTORS, Stellite
American Telescope Labs.
Bausch & Lomb Optical
Fecker, J. W.
Kollmorgen Optical Co.
Perkin-Elmer Corp.

Kieley & Mueller PRODUCTS

62nd YEAR

A complete range of sizes and types in

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Regulators
Liquid Level Controls
Strainers
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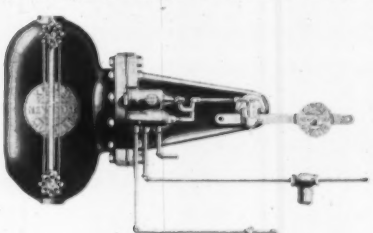
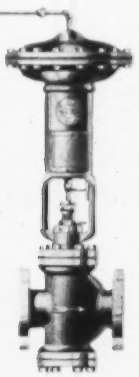
Engineering Specialties





Custom Sub-assemblies for all Valve Requirements

KIELEY & MUELLER, INC.
General Offices—40 West 13th St., N. Y. C.
Factory at Newark, N. J.

YOUR CONTROL ENGINEERS

For addresses, see pages 66-76

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Bausch & Lomb Optical
Central Scientific Co.
Fuess, Inc.
Industro-Scientific Co.
Jarrell-Ash Co.
Leiska & Co.
Spencer Lens Co.
Zeiss, Inc., Carl

REFRACTORY TUBES
Coors Porcelain Co.

REGULATORS, AUTOMATIC (See also Controls, Automatic; and object of measurement and control)

REGULATORS, AUTOMATIC, Air
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American Meter Co.
Area Regulators, Inc.
Askania Regulator Co.
Bailey Meter Co.
Bastian-Blessing Co.
Beckel & Co.
Boylston Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Cutler-Hammer, Inc.
Davis Reg. Co.
D'Este Co.
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Dockson Co.
Fisher Governor Co.
Foster Engg. Co.
Foxboro Co.
Friez & Sons
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General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.
Hoke, Inc.
Johnson Service Co.
Judson Governor Co.
Kiely & Mueller
Lammert & Mann Co.
Leslie Co.
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McCorkle Co.
Mercoid Regulator Co.
National Airoil Burner
Natural Gas Equipment
Northern Equip. Co.
Parks-Cramer Co.
Partlow Corp.
Payne Furnace & Supply
Penn Electric Switch Co.
Pgh. Equitable Meter
Powers Regulator Co.
Preferred Utilities Mfg.
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Reynolds Gas Regulator
Robertshaw Thermostat
Ruggles-Klingemann
Schade Valve Mfg.
Sprague Meter Co.
Tagliabue Mfg. Co.
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Vaughn-G.E. Witt Co.
Victor Equipment Co.
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Wilgus Mfg. Co.

REGULATORS, AUTOMATIC, Atmospheric
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Mason-Neilan Regulator
Parks-Cramer Co.
Powers Regulator Co.
Robertshaw Thermostat

REGULATORS, AUTOMATIC, Boiler
Askania Regulator Co.
Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Fisher Governor Co.
Foster Engg. Co.
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Penn Electric Switch
Perfex Corp.
Republic Flow Meters
Robertshaw Thermostat
Ruggles-Klingemann
Tagliabue Mfg. Co.
Wilgus Mfg. Co.

(Continued on page 34)

REGULATORS, AUTOMATIC, Compressed Gas
American Meter Co.
Bailey Meter Co.
Brooke Eng. Co.
Brown Inst. Co.
Cash Co.
Dockson Co.
Electrimatic Corp.
Fisher Governor Co.
Frick Co.
Hanlon-Waters, Inc.
Hoke, Inc.

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REGULATORS, AUTOMATIC, Compressed Gas (Continued)
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McAlear Mfg. Co.
Mercoid Regulator Co.
Natural Gas Equipment
Pgh. Equitable Meter
Republic Flow Meters
Reynolds Gas Regulator
Robertshaw Thermostat
Tagliabue Mfg. Co.
Victor Equipment Co.

REGULATORS, AUTOMATIC, Condensation (See Controllers, Automatic, Condensation)

REGULATORS, AUTOMATIC, Consistency (Paper & Pulp) (See Controllers, Automatic, Consistency)

REGULATORS, AUTOMATIC, Current
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Amperite Corp.
Beck Bros.
Betts & Betts
Burlington Inst. Corp.
Cutler-Hammer, Inc.
General Elec. Co.
Monitor Controller Co.
Robertshaw Thermostat
Roller-Smith Co.

REGULATORS, AUTOMATIC, Damper (See Controllers, Automatic, Damper)

REGULATORS, AUTOMATIC, District (See Governors, District)

REGULATORS, AUTOMATIC, Draft (See Controllers, Automatic, Draft)

REGULATORS, AUTOMATIC, Drying Chamber
Powers Regulator Co.
United Cinephone Corp.

REGULATORS, AUTOMATIC, Feed Water
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Brown Inst. Co.
Cochrane Corp.
Davis Reg. Co.
Defender Automatic Reg.
General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.
Mason-Neilan Regulator
McAlear Mfg. Co.
McDonnell & Miller
Mercoid Regulator Co.
Minneapolis-Honeywell
Natural Gas Equipment
Northern Equip. Co.
Ruggles-Klingemann
Stets Co.
Tagliabue Mfg. Co.
Vaughn-G.E. Witt Co.
Watts Regulator Co.
Wilgus Mfg. Co.
Williams Gauge Co.

REGULATORS, AUTOMATIC, Flow (See Controllers, Automatic, Flow)

REGULATORS, AUTOMATIC, Flow Proportioning (See Controllers, Automatic, Flow Proportioning)

REGULATORS, AUTOMATIC, Fluid Proportioning (See Controllers, Automatic, Fluid Proportioning)

REGULATORS, AUTOMATIC, Frequency
Burlington Inst. Corp.
General Elec. Co.
Warren Telechron Co.
Wheelco Inst. Co.

REGULATORS, AUTOMATIC, Furnace (See Controllers, Automatic, Furnace)

REGULATORS, AUTOMATIC, Gas (See Regulators, Automatic, Air)

REGULATORS, AUTOMATIC, Humidity (See Controllers, Automatic, Humidity)

REGULATORS, AUTOMATIC, Liquid Level (See Controllers, Automatic, Liquid Level)

REGULATORS, AUTOMATIC, Load
Allis-Chalmers Mfg. Co.
Autom'c Valve Controller
Hays Corp.
Leeds & Northrup Co.
Taylor Inst. Cos.

REGULATORS, AUTOMATIC, Oil Feed
Askania Regulator Co.
Atlas Valve Co.
Brown Inst. Co.
Cash Co.
D'Este Co.
Fisher Governor
Foster Engg. Co.
General Regulator Corp.
Hagan Corp.

(Cont'd)

REGULATORS, AUTOMATIC Oil Feed (Continued)
Lammert & Mann Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
McCorkle Co.
National Airoil Burner
Republic Flow Meters
Spence Engineering Co.
Taylor Inst. Cos.
United Cinephone Corp.
Vaughn-G.E. Witt Co.
Wilgus Manufacturing

REGULATORS, AUTOMATIC, Power Factor
Allis-Chalmers Mfg. Co.
Leeds & Northrup Co.
United Cinephone Corp.

REGULATORS, AUTOMATIC, Pressure (See Controllers, Automatic, Pressure)

REGULATORS, AUTOMATIC, Pump
Allen-Bradley Co.
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Bailey Meter Co.
Bellfield Co.
Boylston Co.
Brown Inst. Co.
Builders Iron Foundry
Cash Co.
Davis Reg. Co.
D'Este Co.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Furnas Electric Co.
General Regulator Corp.
Hagan Corp.
Hanlon-Waters, Inc.
Hydraulic Press Co.
Klipfel Mfg. Co.
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Mercoid Regulator Co.
Northern Equip. Co.
Penn Electric Switch
Republic Flow Meters
Water Level Controls Co.
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Vaughn-G.E. Witt Co.
Watts Regulator Co.
Wilgus Mfg. Co.

REGULATORS, AUTOMATIC, Refrigeration (See Controllers, Automatic, Refrigeration)

REGULATORS, AUTOMATIC, RKVA
Allis-Chalmers Mfg. Co.

REGULATORS, AUTOMATIC, Safety Fuel Shut-Off (See Valves, Automatic, Safety Fuel Shut-Off)

REGULATORS, AUTOMATIC, Speed (See Controllers, Automatic, Speed)

REGULATORS, AUTOMATIC, Steam (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Steam Pressure (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Synchronizing
Allis-Chalmers Mfg. Co.
Industrial Engr. Corp.
Magnetic Gauge Co.

REGULATORS, AUTOMATIC, Temperature (See Controllers, Automatic, Temperature)

REGULATORS, AUTOMATIC, Time (See Controllers, Automatic, Time)

REGULATORS, AUTOMATIC, Vacuum (See Controllers, Automatic, Vacuum)

REGULATORS, AUTOMATIC, Viscosity (See Controllers, Automatic, Viscosity)

REGULATORS, AUTOMATIC, Voltage
Allis-Chalmers Mfg. Co.
American Transformer
Amperite Corp.
Burlington Inst. Corp.
Clarostat Mfg. Co.
Eclipse Aviation
Electronic Prod. Co.
Ferris Inst. Corp.
Fredericks, George
General Elec. Co.
Ideal Commutator Dresser
International Resistance
Jones-Oeme Co.
Luxtrol Co., Inc.
Miller Co., Bertrand F.
Raytheon Mfg. Co.
Roller-Smith Co.
Sola Electric Co.
United Cinephone Corp.
United Transformer Corp.
Ward Leonard Elec. Co.

REGULATORS, AUTOMATIC, Water Pressure (See Regulators, Automatic, Pressure)

REGULATORS, AUTOMATIC, Welding, Gas
Bastian-Blessing Co.
Dockson Co.
Victor Equipment Co.

REGULATORS, MANUAL (Non-Automatic)
Allen-Bradley Co.
Bailey Meter Co.
Beck Bros.
Bellfield Co.
Brown Inst. Co.
Cutler-Hammer, Inc.
Fisher Governor
Hanlon-Waters, Inc.
McAlear Mfg. Co.
National Airoil Burner
National Elec. Controller
Pioneer Instrument
Standard Elec. Prods.
Superior Electric Co.
Tagliabue Mfg. Co.
United Transformer Corp.
Ward Leonard Elec. Co.

RELAYS, Automatic
Allen-Bradley Co.
American Inst. Co.
American Automatic Elec.
Autocall Co.
Clare & Co.
Cutler-Hammer, Inc.
Eclipse Aviation
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hagan Corp.
Industrial Eng. Corp.
Kellogg Switchboard
Mercoid Corp.
Minneapolis-Honeywell
Monitor Controller Co.
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Capacity-Operated
Electronic Lab.
Luxtrol Co., Inc.

RELAYS, Circuit Control
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Brown Inst. Co.
Clare & Co.
Electric Controller
Friez & Sons
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kellogg Switchboard
Leach Relay Co.
Lumenite Elec. Co.
Miller Co., Bertrand F.
Minneapolis-Honeywell
Monitor Controller Co.
Paragon Electric Co.
Sigma Instruments, Inc.
Standard Elec. Prods.
Struthers-Dunn
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

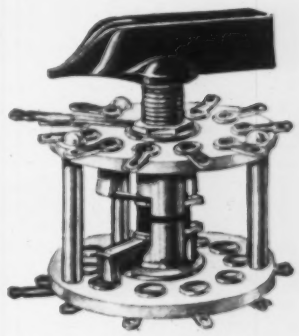
RELAYS, Continuous Current
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Clare & Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kellogg Switchboard
Paragon Electric Co.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Control
Allen-Bradley Co.
Advance Electric Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Betts & Betts
Brown Inst. Co.
Clare & Co.
Cutler-Hammer, Inc.
Electric Controller
Friez & Sons
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hagan Corp.
H-B Inst. Co., Inc.
Industrial Eng. Corp.
Kellogg Switchboard
Miller Co., Bertrand F.
Minneapolis-Honeywell
Monitor Controller Co.
Perfex Corp.
Precision Therm. & Inst.
Roller-Smith Co.
Standard Elect. Prods.
Struthers-Dunn
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

FOR *Permanent* LOW CONTACT RESISTANCE, *use the*

SHALLCROSS

ROTARY SELECTOR SWITCH



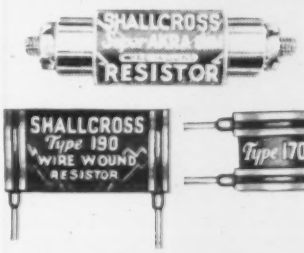
Particularly designed for use with the Thermocouple and other instrument circuits, also to control circuits such as found in high grade electrical apparatus.

Made with a very superior ceramic switch plate known as "steatite" and has *eleven solid "fine" silver contacts and contact arms.* The average contact resistance in this switch is .00075 ohms or less. Supplied with more or fewer contacts, with or without stops, shorting (bridging) or non-shorting.

Cost slightly more — but worth much more because they last longer, are more accurate.

Write for Switch Bulletin No. 141-HS

"Akra-Ohm" Resistors



Precision calibrated resistors can be furnished with an accuracy of 1%, .5%, .25% and 0.1%; ranging from .1 ohm to 10,000,000 ohms. Available in many types and forms described in Bulletin No. 122-HS.

SHALLCROSS MFG. CO.
Instruments — Resistors — Switches
COLLINGDALE, PA.

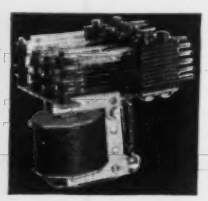
For addresses, see pages 66-76

RELAYS by GUARDIAN

. . . for AC or DC Operation —

★ Relays—Solenoids and Stepping Switches illustrated below suggest a few of the numerous types of Electrical Control Units obtainable at Guardian Electric, in both industrial and *Government Approved* types.

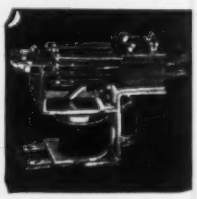
If you need COMPACT and highly sensitive control's that possess quick responsiveness and precision of action—with MAXIMUM CONTROL in *minimum space*—you will get it ALL at Guardian. Controls by Guardian are furnished to operate on any specified voltage up to 220 DC—440 AC—and on any current from .5 milliamperes to 30 amperes. Contact capacities to 1500 watts.



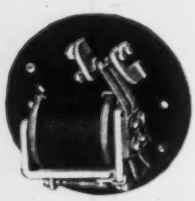
ALTERNATING CURRENT RELAYS

Series 30 AC. (left) Supplied in three types of mountings, voltage range .1 to 440 volts, contact capacity 42 contacts. Size 2¾x1½x2½".

Series 110 AC. (right) Compact, economical, widely used unit. Four pole, double throw contact capacity, 220 volt limit. Size 2¾x3⅞x1 15/16".

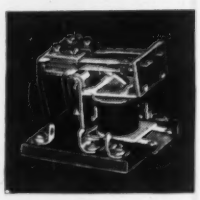


DIRECT CURRENT RELAYS



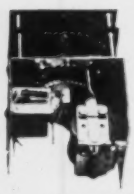
Series 5 DC (left) Current draw as low as .009 watts—furnished completely enclosed—contact limit, double pole, double throw. Size 3¼x3¾x2".

Series 115 DC (right) Four pole, double throw contact capacity, rapid change over of contacts, full floating, permanently locked armature, economical of space and cost.

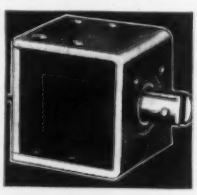


S-T-E-P-P-I-N-G RELAYS

Versatile, advanced designs, simple in principle. New applications for these units are appearing constantly giving circuit control hitherto thought impossible. Rigidity of construction guarantees long life. Innumerable variations available. A.C. or D.C.



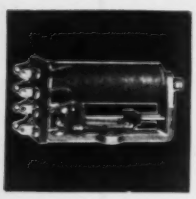
Type-R Stepping Relay



SOLENOIDS —AC; DC

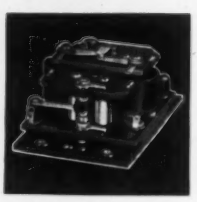
Type No. 2. Efficient—powerful—compact. For electro-mechanical operations involving remote control of mechanical motions such as electric counting, valve control and operation, faulty material ejector, automatic brake, electric racheting, etc. 1⅛x1½x1⅝".

GOVERNMENT APPROVED RELAYS



BK-10 RELAY (left) Precisely counter-balanced to resist extreme vibrations. Built to rigid U.S. Signal Corps specifications.

BK-16 RELAY (right) Built to minimum toleratances. A production line product. Furnished to custom-built specifications. Another Signal Corp Relay by Guardian.



★ **WRITE TO GUARDIAN** for free engineering assistance on any electrical control problem. No obligation. Ask for Bulletin 1941 Catalog L, with illustrations and specifications on our complete line.

GUARDIAN ELECTRIC

1621 West Walnut Street Chicago, Illinois

RELAYS, Demand Totalizing
Autocall Co.
General Elec. Co.
Hagan Corp.
Therm-Electric Meters Co.
United Cinephone Corp.
Westinghouse Elec. & Mfg.

RELAYS, Electromagnetic
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Bunnell & Co.
Eby, Inc.
Clare & Co.
Cutler-Hammer, Inc.
Friez & Sons
General Elec. Co.
G-M Labs.
Guardian Elec. Mfg. Co.
H-B Inst. Co.
Industrial Eng. Corp.
Kellogg Switchboard
Kurman Electric Co.
Leach Relay Co.
Miller Co., Bertrand F.
Minneapolis-Honeywell
Monitor Controller Co.
Penn Electric Switch Co.
Perfex Corp.
Phila. Thermometer Co.
Precision Therm. & Inst.
Sigma Instruments, Inc.
Standard Elect. Prods.
Struthers-Dunn
United Cinephone Corp.
Ward Leonard Elec. Co.
Western Electro-Mech.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
White-Rodgers Electric
Zenith Electric Co.

RELAYS, Frequency
Autocall Co.
Clare & Co., C. P.
Cutler-Hammer, Inc.
Esterline-Angus Co.
Hickok Electrical Inst.
United Cinephone Corp.
Ward Leonard Electric Co.

RELAYS, Galvanometer
Autocall Co.
Eby, Inc., Hugh H.
G-M Laboratories, Inc.
Rubicon Co.
Tagliabue Mfg. Co., C. J.

RELAYS, Heavy Duty
Allen-Bradley Co.
American Automatic Elec.
American Inst. Co.
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
General Elec. Co.
H-B Inst. Co., Inc.
Miller Co., Bertrand F.
Monitor Controller Co.
Penn Electric Switch
Philadelphia Thermometer
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Zenith Electric Co.

RELAYS, Instrument Controlled
American Automatic Elec.
American Inst. Co.
Autocall Co.
Brown Inst. Co.
Clare & Co.
Cramer & Co., Inc.
Friez & Sons
General Elec. Co.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Kurman Electric Co.
Minneapolis-Honeywell
Pertex Corp.
Phila. Thermometer Co.
Precision Therm. & Inst.
Roller-Smith Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Triplett Electrical Inst.
United Cinephone Corp.
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.

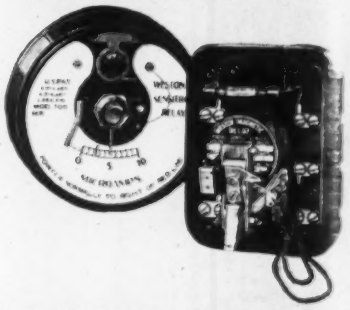
RELAYS, Light Sensitive (See Photoelectric below)

RELAYS, Magnetic (See Relays, Electro-Magnet)

RELAYS, Mercury
American Automatic Elec.
American Inst. Co.
Autocall Co.
Continental Elec. Co.
Guardian Electric
H-B Elec. Co., Inc.
Loewenberg, F.
Precision Therm. & Inst.
Weston Elec. Inst. Corp.

RELAYS, Mercury Tube
American Inst. Co.
Autocall Co.
Brown Inst. Co.
Clare & Co.
General Control Co.
G-M Labs.
Guardian Elec. Mfg. Co.
H-B Elec. Co., Inc.
Minneapolis-Honeywell
Phila. Thermometer Co.
Precision Therm. & Inst.
Struthers-Dunn
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.

SENSITIVE and POWER RELAYS



A complete line of sensitive relays and contact making indicators . . . including the Sensitrol Relay which provides positive control at energy levels as low as 1 millivolt or 2 microamperes, handling 5 watts at 110 volts on magnetic contacts. Also Time Delay Relays and Power Relays for operation from sensitive relay contacts. Bulletins available. Weston Electrical Instrument Corporation, 591 Frelinghuysen Ave., Newark, New Jersey.

WESTON *Instruments*

AGASTAT

The Name for TIME-DELAY RELAY

An instantaneous recycling unit giving a delay interval ranging from a fraction of a second to several minutes, for use in electrical apparatus and equipment.

Positive, snap-action contacts, normally open, normally closed, or both. Single or double-pole. Offers a diversity of timing effects by different circuit combinations. Simple field adjustment. Unaffected by dust, temperature, humidity or voltage fluctuations.

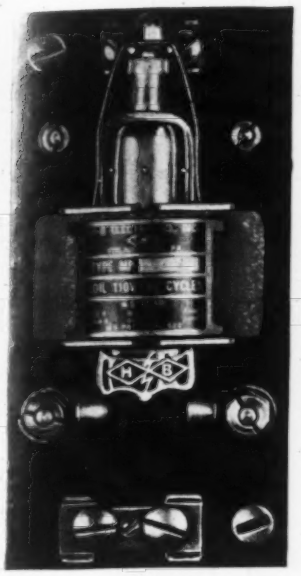
Write Today for Bulletin N-4.

AMERICAN GAS ACCUMULATOR CO.

Electrical Division

ELIZABETH • NEW JERSEY

For addresses, see pages 66-76



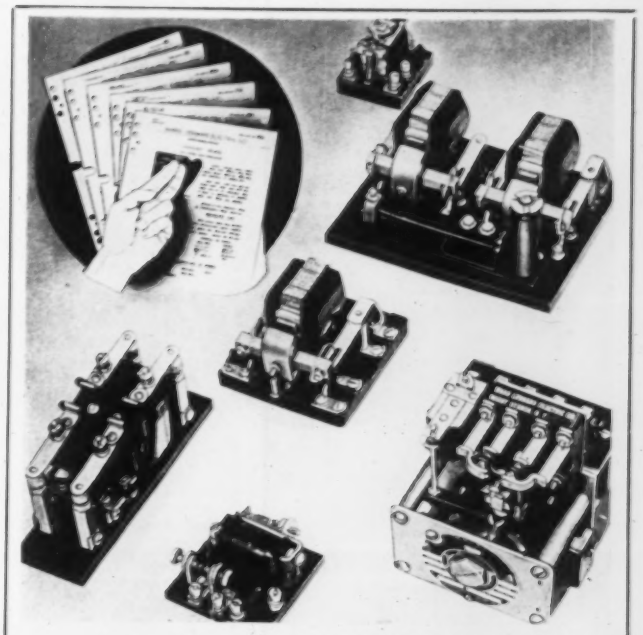
★

SENSITIVE RELAY IMPROVES INSTRUMENT PERFORMANCE

★

★ Your instruments can be made more sensitive with the use of this H-B relay. Maintenance-free and tested for ten million uninterrupted operations. Dirt or dust can't stop it. The relay with only one moving part—simplicity assures long life. Bulletin A fully describing its many features sent on request.

H-B ELECTRIC COMPANY INC.
MANUFACTURERS OF H B ELECTRICAL DEVICES
2501 N. BROAD STREET, PHILADELPHIA, PENNA.



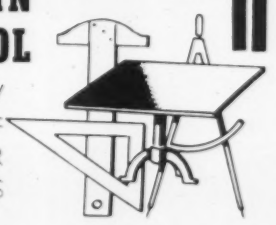
SEND FOR THIS
RELAY DATA

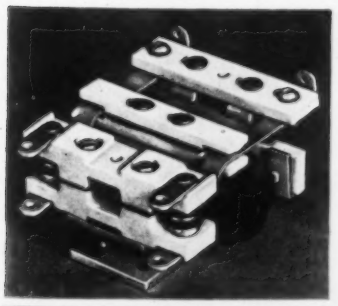
Describing midget, intermediate, and heavy duty, sensitive type, time delay and meter driven relays in all contact combinations.

WARD LEONARD
38 SOUTH STREET MOUNT VERNON, N. Y.
ELECTRIC CONTROLS SINCE 1892

DESIGNED...
FOR ACCURACY IN ELECTRIC CONTROL

RUGGED, COMPACT, LOW POWER CONSUMPTION OF 1.5 WATTS, HIGH POWER OUTPUT OF 2,000 WATTS



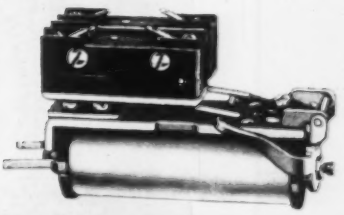


This Kurman relay was designed to meet the need for a high quality medium duty relay at low cost. The magnet coil is wound on a Bakelite core and Alsimag non-hygroscopic insulation is employed. Contacts are quarter inch coin silver.

KURMAN ELECTRIC CO.
INCORPORATED
241 Lafayette Street, New York, N. Y.

CLARE *Type "F"*

Micro-switch • Snap-action Contact



RELAY

Operates on a *few milli-amperes*—contacts carry *10 amperes 110 V. a.c.* Particularly adapted to machine control, motor and lamp loads, photo electric, and similar applications.

C. P. CLARE & CO.
LAWRENCE & LAMON AVES. - - CHICAGO
15 EAST 26TH STREET NEW YORK CITY

CLARE *Type "FM"*

Snap-action Contact

RELAY

For slightly heavier loads—contacts rated *15 amperes 110 V. a.c.* Operates on low coil current and adaptable to similar applications.

Write for Clare Data Book and Catalog today.

Precision Resistor Company

MICROHM

WIRE WOUND RESISTORS

A Preferred Product

•

OUTSTANDING CONCERNS

REPEAT and REPEAT

AGAIN and AGAIN

THEIR PURCHASES OF

MICROHM

RESISTORS

Continued Preference is Best Proof of Uniform, Constant, Dependable QUALITY

Complete service and advice on any and all of your resistance and equipment problems.

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Precision Resistor Company

334 BADGER AVENUE • NEWARK, N. J.

Super DAVOHM

wire wound PRECISION RESISTORS

Recommended for use in exacting equipment where accuracy, stability and dependability over long periods of time are of prime importance.

Accuracies from ± 1% to ± 0.1% available

Prices and literature upon request

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RELAYS, Motor Driven Time Delay
Advance Electric Co.
American Inst. Co.
Betts & Betts
Controls, Inc.
Cramer & Co., Inc.
Squthw'n Electronics Lab.
Struthers-Dunn
Friez & Sons
General Elec. Co.
Industrial Eng. Corp.
Monitor Controller Co.
Paragon Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
Zenith Electric Co.

RELAYS, Movable Coil A.C.
Esterline-Angus Co.
General Elec. Co.
Weston Elec. Inst. Corp.

RELAYS, Overload
Allen-Bradley Co.
Autocall Co.
Bunnell & Co.
Burlington Inst. Corp.
Cutler-Hammer, Inc.
Edison Electrical Controls
Electric Controller
General Elec. Co.
Guardian Elec. Mfg. Co.
Leach Relay Co.
Penn Electric Switch
Roller-Smith Co.
Standard Elect. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.

RELAYS, Permanent Magnet Movable Coil
Bunnell & Co.
Esterline-Angus Co.
General Elec. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

RELAYS, Photoelectric
Advance Electric Co.
American Inst. Co.
Eby, Inc.
Clare & Co.
Continental Elec. Co.
Cutler-Hammer, Inc.
Dickson Co.
Electronic Lab.
Electronic Prod. Co.
Ess Instrument Co.
General Controls Co.
General Elec. Co.
G-M Labs.
Leach Relay Co.
Lipman Engg. Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Photobell Corp.
Photoswitch, Inc.
Precision Therm. & Inst.
Rehtron Corp.
Sigma Instruments, Inc.
Tagliabua Mfg. Co.
United Cinephone Corp.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Polarized
American Automatic Elec.
Autocall Co.
Edison Electrical Controls
L. A. B. Corp.
Miller Co., Bertrand F.
Precision Therm. & Inst.
Struthers-Dunn
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Power
American Automatic Elec.
American Inst. Co.
Automatic Switch Co.
Esterline-Angus Co.
General Controls Co.
General Elec. Co.
Hagan Corp.
Struthers-Dunn
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

RELAYS, Power Factor
Esterline-Angus Co.
L. A. B. Corp.
Westinghouse Elec. & Mfg.

RELAYS, Resistance, D-c.
Advance Electric Co.
Autocall Co.
Automatic Electric Co.
Bunnell & Co.
Clare & Co., C. P.
Cutler-Hammer, Inc.
Dunn, Inc., Struthers
Guardian Electric
Leach Relay Co.
Standard Elect. Products

RELAYS, Stepping
Autocall Co.
Automatic Electric Co.
Dunn, Inc., Struthers
G-M Laboratories, Inc.
Guardian Electric
Roller-Smith Co.

RELAYS, Telephone Auxiliary Ringing
Advance Electric Co.
American Automatic Elec.
Autocall Co.
Clare & Co.
Kellogg Switchboard
Kurman Electric Co.
Leach Relay Co.
Standard Elect. Prods.
Struthers-Dunn
Western Electro-Mech.

RELAYS, Temperature
Autocall Co.
Clare & Co., C. P.
Dunn, Inc., Struthers
Edison Electrical Controls
Friez & Sons
Gleason-Avery, Inc.
G-M Laboratories, Inc.
Guardian Electric
Leach Relay Co.
Minneapolis-Honeywell
Photobell Corp.
Spencer Thermostat Co.
Tagliabue Mfg. Co., C. J.
United Cinephone Corp.
Weston Electrical Inst.

RELAYS, Thermal Time Delay
Advance Electric Co.
Allen-Bradley Co.
American Automatic Elec.
Am. Gas Accumulator
American Inst. Co.
Autocall Co.
Automatic Temp. Control
Betts & Betts
Cramer & Co., Inc.
Cutler-Hammer, Inc.
Eagle Signal Corp.
Edison Electrical Controls
Electric Controller
Electronic Prod. Co.
Friez & Sons, Jr.
General Elec. Co.
Guardian Elec. Mfg. Co.
Industrial Eng. Corp.
Loewenberg, F.
Luxtrol Co., Inc.
Magnetic Gauge Co.
Paragon Electric Co.
Perfex Corp.
Photobell Corp.
Precision Therm. & Inst.
Preferred Utilities Mfg.
Spencer Thermostat Co.
Standard Elect. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Weston Elec. Inst. Corp.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
White-Rodgers Electric
Zenith Electric Co.

RELAYS, Time Delay (See Relays, Thermal Time Delay)

RELAYS, Transformer (Low Voltage)
Allen-Bradley Co.
Eclipse Aviation
Friez & Sons
General Controls Co.
Gleason-Avery, Inc.
Guardian Elec. Mfg. Co.
H-B Inst. Co., Inc.
Industrial Eng. Corp.
Miller Co., Bertrand F.
Minneapolis-Honeywell
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Sigma Instruments, Inc.
Struthers-Dunn
Westinghouse Elec. & Mfg.
White-Rodgers Electric

RELAYS, Vacuum Contact
American Automatic Elec.
American Inst. Co.
Edison Electrical Controls

RELAYS, Vacuum Tube
American Inst. Co.
Continental Elec. Co.
Eby, Inc.
Electro-Medical Lab.
Electronic Prod. Co.
General Controls Co.
General Elec. Co.
G-M Labs.
L. A. B. Corp.
Lumenite Elec. Co.
Luxtrol Co., Inc.
Photobell Corp.
Precision Therm. & Inst.
RCA Manufacturing Co.
Sargent & Co.
Sigma Instruments
Standard Elect. Prods.
Struthers-Dunn
Tagliabue Mfg. Co.
United Cinephone Corp.

RELAYS, Voltage
Advance Electric Co.
Allen-Bradley Co.
Autocall Co.
Automatic Switch Co.
Clare & Co., C. P.
Cutler-Hammer, Inc.
Dunn, Inc., Struthers
Eby, Inc., Hugh H.
Esterline-Angus Co.
Ferranti Electric, Inc.
Hart Manufacturing Co.
Hathaway Inst. Co.
Leach Relay Co.
Photobell Corp.
Reliance Instrument Co.
Roller-Smith Co.
Standard Elect. Products
Ward Leonard Electric Co.
Triplett Electrical Inst.
Weston Electrical Inst.

REMOTE-CONTROL EQUIPMENT
Allen-Bradley Co.
American Automatic Elec.
Area Regulators, Inc.
Askania Regulator Co.
Atlas Valve Co.
Autocall Co.
Bailey Meter Co.
Bristol Co.
Brooke Eng. Co.
Brown Inst. Co.
Clare & Co.
Cutler-Hammer, Inc.
Davis Reg. Co.
Elec. Indicator Corp.
Electrimatic Corp.
Electronic Lab.
Elsbett Mfg. Co.
Foxboro Co.
General Elec. Co.
Guardian Electric
Hagan Corp.
Hanlon-Waters, Inc.
Hart Mfg. Co.
Hays Corp.
H-B Inst. Co., Inc.
Illinois Eng. Co.
International Filter Co.
Kollsman Inst. Co.
Kurman Electric Co.
Luxtrol Co., Inc.
Mason-Neilan Regulator
Minneapolis-Honeywell
Perfex Corp.
Photobell Corp.
Powers Regulator Co.
RCA Manufacturing Co.
Republic Flow Meters
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Cinephone Corp.
Zenith Electric Co.

REMOTE-METERING EQUIPMENT, ELECTRICAL
Andrew Victor J.
Automatic Temp. Control
Bristol Co.
Brown Inst. Co.
Builders Iron Foundry
Elec. Indicator Corp.
Elec. Tachometer Corp.
Esterline-Angus Co.
Foxboro Co.
General Elec. Co.
W. & L. E. Gurley
Kellogg Switchboard
Kurman Electric Co.
L. A. B. Corp.
Leeds & Northrup Co.
Mason-Neilan Regulator
Moisture Register Co.
Morey & Jones, Ltd.
Pioneer Instrument
Republic Flow Meters
Tagliabue Mfg. Co.
Therm-Electric Meters
Westinghouse Elec. & Mfg.

REMOTE-METERING EQUIPMENT, HYDRAULIC
Brown Inst. Co.
Builders Iron Foundry
International Filter Co.
Leupold, Volpel & Co.
Westinghouse Elec. & Mfg.

REMOTE-METERING EQUIPMENT, PNEUMATIC
American Meter Co.
Bristol Co.
Brown Inst. Co.
Foxboro Co.
Mason-Neilan Regulator
Taylor Inst. Cos.

RESISTANCE LOADING EQUIPMENT
Eastern Specialty Co.
Hardwick, Hindle, Inc.
International Resistance
Precision Resistor Co.

RESISTANCES
Allen-Bradley Co.
Beck Bros.
Central Scientific Co.
Clarostat Mfg. Co.
Cutler-Hammer, Inc.
Daven Co.
General Radio Co.
Instrument Resistors, Inc.
International Resistance
Ohmite Mfg. Co.
Precision Resistor Co.
Sensitive Research Inst.
Shallcross Mfg. Co.

RESISTORS, Adjustable
Ward Leonard Electric Co.

RESISTORS, CARBON COMPRESSION
Allen-Bradley Co.
Beck Bros.
International Resistance
Le Carbone Co., Inc.
Nat'l Carbon Co., Inc.
Ohio Carbon Co.
O. S. Peters
Speer Carbon Co.
Welch Scientific Co.
Eastern Specialty Co.
Hardwick, Hindle, Inc.
International Resistance
Precision Resistor Co.

RESISTORS, High Frequency
Beck Bros.
Daven Co.
General Radio Co.
Hardwick, Hindle, Inc.
Instrument Resistors, Inc.
International Resistance
Leeds & Northrup Co.
Measurements Corp.
Ohmite Mfg. Co.
Shallcross Mfg. Co.
Ward Leonard Electric Co.

RESISTORS, High Voltage
Beck Bros.
Clarostat Mfg. Co.
Hardwick, Hindle, Inc.
Instrument Resistors, Inc.
International Resistance
J B L Instrument Co.
Ohmite Mfg. Co.
Shallcross Mfg. Co.
Ward Leonard Electric Co.

RESISTORS, Manganin
Beck Bros.
Daven Co.
General Radio Co.
Gray Instrument Co.
Hardwick, Hindle, Inc.
Instrument Resistors, Inc.
Leeds & Northrup Co.
Rubicon Co.
Shallcross Mfg. Co.

RESISTORS, Molded
Allen-Bradley Co.
Beck Bros.
Clarostat Mfg. Co.
International Resistance
Muter Co.
Triplett Electrical Inst.

RESISTORS, Standard (See Standards, Resistance)

RESISTORS, Variable
Allen-Bradley Co.
Beck Bros.
Clarostat Mfg. Co.
Cutler-Hammer, Inc.
General Radio Co.
Gray Instrument Co.
Hardwick, Hindle, Inc.
Instrument Resistors, Inc.
International Resistance
Leeds & Northrup Co.
National Electric Control
Ohmite Mfg. Co.
Rex Rheostat Co.
Rubicon Co.

Taylor

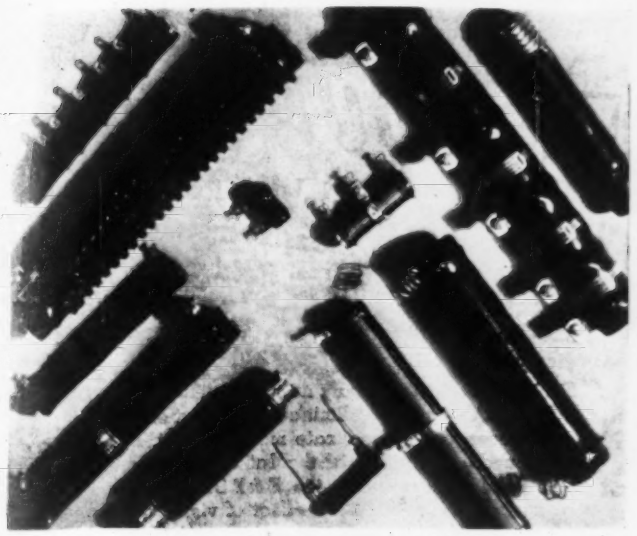
Remote Pneumatic Transmission Systems

Write for complete information and catalogs.

Taylor Instrument Companies

ROCHESTER, N.Y. TORONTO, CANADA

For addresses, see pages 66-76



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Send for circular 507. It not only gives Resistor data but other valuable dope for the ham.

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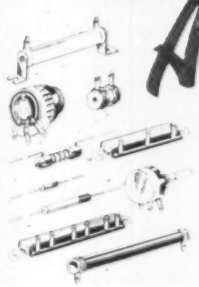
ELECTRIC CONTROL DEVICES SINCE 1892

RESISTOR PROBLEMS *Answered!*



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- 2 sizes Variable Metallized Controls
- 4 sizes Insulated Metallized Resistors
- 10 sizes High Frequency Metallized Resistors (1 3 to 150 watts)
- 4 sizes Ultra-High Range Metallized Resistors
- 3 sizes All-Metal Power Rheostats (2 to 50 watts)
- 2 sizes Attenuators
- 7 sizes Insulated Wire Wound Resistors ($\frac{1}{2}$ to 20 watts)
- 5 sizes High Voltage Metallized Resistors
- 5 sizes Metallized Suppressors
- 12 sizes Precision Wire Wound Resistors
- 53 sizes Fixed and Variable Power Wire Wound Resistors

INTERNATIONAL RESISTANCE COMPANY

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IRC

Get this Handy New
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Ohm's Law Calculator

Solves any Ohm's Law Problem with one setting of the slide.

Here's the handiest Ohm's Law Calculator ever devised. Figures Amperes, Volts, Watts, Ohms—quickly, easily, accurately! Requires no slide rule knowledge. All values are direct reading. Scales on both sides cover the current and wattage range for motors, generators, lamps, electrical apparatus and other applications up to 100 amperes or 1000 watts; also the low current high resistance radio, sound and electronic applications. Has convenient Stock Unit Selector—a setting of the slide tells the stock number of the resistor or rheostat you may need. Size 4⅛"x9". Specially designed by Ohmite Engineers. Available for only 10c to cover handling cost.

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Firm Name .....
Position .....
Address .....
City ..... State .....

Instruments—Jan

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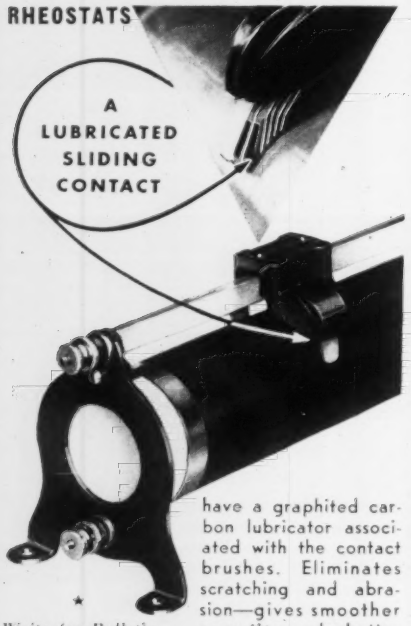
RHEOSTATS • RESISTORS • TAP SWITCHES

JAGABI *"Lubri-tact"* RHEOSTATS



have a graphited carbon lubricator associated with the contact brushes. Eliminates scratching and abrasion—gives smoother operation and a better contact. Makes Jagabi Rheostats *better* rheostats.

Write for Bulletin 1620-I which lists new lower prices.

JAMES G. BIDDLE CO.
Electrical Instruments
1211-13 Arch Street Philadelphia, Pa.

Rex Four-Range Rheostats
with Lubricated contacts
A New Development

Write for Bulletin S.

THIS rheostat incorporates 4 different ohmic resistance values, for instance—Cat. No. 421:

1. **RANGE:** 465 ohms, .8 amps.
2. **RANGE:** 320 ohms, 1 amps.
3. **RANGE:** 145 ohms, 1.5 amps.
4. **RANGE:** 100 ohms, 1.8 amps.

Available in 2 sizes: 350 and 650 Watt; 10 Units.

Rex Rheostat Co.
37 West 20th St., New York, N. Y.

RESISTORS, Wire Wound
Beck Bros.
Biddle Co., Jas. G.
Clarostat Mfg. Co.
Cutler-Hammer, Inc.
Daven Co.
General Radio Co.
Gray Instrument Co.
Hardwick, Hindle, Inc.
Instrument Resistors, Inc.
International Resistance
Leeds & Northrup Co.
Muter Co.
National Electric Control.
Ohmite Mfg. Co.
Rex Rheostat Co.
Rubicon Co.
Shallcross Mfg. Co.
Triplett Electrical Inst.
Ward Leonard Electric Co.

RHEOSTATS, Battery Charging
Allen-Bradley Co.
Beck Bros.
Cutler-Hammer, Inc.
Hardwick, Hindle, Inc.
International Resistance
National Elec. Controller
Ohmite Mfg. Co.
Rex Rheostat Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.

RHEOSTATS, Laboratory
Allen-Bradley Co.
American Inst. Co.
Beck Bros.
Biddle Co., Jas. G.
De Jur-Amsco Corp.
Central Scientific Co.
Chicago Apparatus Co.
Eastern Specialty Co.
General Radio Co.
G-M Labs.
Hardwick, Hindle, Inc.
National Elec. Controller
Ohmite Mfg. Co.
Rex Rheostat Co.
Rubicon Co.
Schaefer Bros. Co.
Ward Leonard Elec. Co.

RHEOSTATS, Meter Testing
Allen-Bradley Co.
Beck Bros.
Biddle Co., Jas. G.
De Jur-Amsco Corp.
Eastern Specialty Co.
Hardwick, Hindle, Inc.
International Resistance
Leeds & Northrup
National Elec. Controller
Ward Leonard Elec. Co.

RHEOSTATS, Slide Wire
Beck Bros.
Biddle Co., Jas. G.
Central Scientific Co.
Chicago Apparatus Co.
General Radio Co.
Hardwick, Hindle, Inc.
G-M Labs.
Leeds & Northrup
National Elec. Controller
Rex Rheostat Co.
Rubicon Co.
Shallcross Mfg. Co.
Ward Leonard Elec. Co.

RIDEOMETERS. RIDE COMFORT Recorders & Riding-Quality Instruments
Commercial Engg. Labs.
Impact Register Co.
Jaeger Watch Co.
Sperry Products, Inc.

RULES, Adjustable Curve (See Drawing Instruments)

RULES, Aluminum
Keuffel & Esser Co.
Lufkin Rule Co.
Warren-Knight Co.

RULES, Brass
Bliss, J. & Co.
Lufkin Rule Co.
Mico Instrument Co.
Starrett Co.
Warren-Knight Co.

RULES, Caliper
Glogau & Co.
Lufkin Rule Co.
Millers Falls Co.
Starrett Co.
Union Tool Co.
Warren-Knight Co.

RULES, Drafting Room (See Drawing Instruments)

RULES, Folding
Bliss & Co.
Dietzen Co.
Keuffel & Esser Co.
Lufkin Rule Co.
Post Co., Frederick
Speidel & Co.
Starrett Co.
Warren-Knight Co.
Weber Co.

RULES, Glass
Fish-Schurman Co.
Glass Engraving Co.
Mico Instrument Co.

RULES, Parallel
Bliss & Co.
Dietzen Co.
Hamilton Mfg. Co.
Keuffel & Esser Co.
Negus, T. S. & J. D.
Speidel & Co.
Warren-Knight Co.
White Co., Inc.
Weber Co.

ANNOUNCING

New F & P STABL-VIS* Rotameter for flow rate measurement unaffected by changing fluid viscosity!

*Trade Mark Reg.

Fischer & Porter Company now offers the STABL-VIS* rotameter designed to eliminate the effect of changing fluid viscosity from flow rate measurement. Based on the sound application of the latest developments in fluid mechanics research, the F & P STABL-VIS rotameter renders negligible the effect of viscosity changes from as low as 0.1 centipoises to as high as 50.0 centipoises on rotameter calibrations.

This F & P development makes complete the superiority of the rotameter sight flow meter over manometer type flow meters. Visibility, accuracy, simplicity of installation, linear scale and corrosion resistance have already established a preference for F & P rotameters with precision-bore tubes. Now, the development of the STABL-VIS rotameter again raises the standards of flow rate measuring practice.

F&P ROTAMETERS

WRITE FOR COMPLETE INFORMATION

FISCHER & PORTER CO.
63 W. QUEEN LANE, PHILADELPHIA, PA.

RULES, Precision Standard
Gaertner Scientific Corp.

RULES, Shrinkage
Keuffel & Esser Co.
Lufkin Rule Co.
Speidel & Co.
Starrett Co.
Warren-Knight Co.
Weber Co.

RULES, Slide (See Drawing Instruments)

RULES, Slide, Psychrometric
Friez & Sons

RULES, Steel
Kern & Co.
Keuffel & Esser Co.
Lufkin Rule Co.
Mico Instrument Co.
Millers Falls Co.
Scherr Co., Inc.
Speidel & Co.
Starrett Co.
Union Tool Co.
Warren-Knight Co.
Weber Co.

RULES, Wood
Heuschel & Co.
Keuffel & Esser Co.
Lufkin Rule Co.
Post Co., Frederick
Speidel & Co.
Warren-Knight Co.
Weber Co.

RUNNING TIME TOTALIZERS
Cramer & Co., Inc.
Elec. Tachometer Corp.
Jaeger Watch Co.
Production Instrument

SACCHARIMETERS
Akatos, Inc.
Bausch & Lomb Opt.
Central Scientific Co.
Eimer & Amend
Moeller Instrument Co.
Rieker Inst. Co.
Sargent & Co.
Trerice Co.

SACCHAROMETERS
Central Scientific Co.
Eimer & Amend
Fleischhauer & Son
G. M. Mfg. Co., Inc.
H.B Inst. Co.
Kimble Glass Co.
Moeller Instrument Co.
Precision Therm. & Inst.
Rascher & Betzold
Rieker Inst. Co.
Ruehfel Co.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Wagner & Son

SALINITY INDICATORS
Bendix Marine Products
Central Scientific Co.
Eimer & Amend
Engineering Labs., Inc.
Fleischhauer & Son
G. M. Mfg. Co., Inc.
H-B Inst. Co.
Leeds & Northrup Co.
McNab of Bridgeport
Moeller Inst. Co.
Precision Therm. & Inst.
Rascher & Betzold
Ruehfel Co.
Schultheis Corp.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.

SALINOMETERS (See Salinity Indicators)

SAMPLER, Boiler Water
Natl. Aluminate Corp.

SAMPLERS, Oil
Braun Corp.
Central Scientific Co.
Pgh. Equitable Meter Refinery Supply Co.
Scientific Glass Apparatus
Tagliabue Mfg. Co.

SAMPLERS, Oil Bottomhole
Ruska & Co., Inc.

SAMPLERS, Sewage
Builders Iron Foundry
Central Scientific Co.
International Filter Co.
Scientific Glass Apparatus

SAMPLERS, Silt
Central Scientific Co.

SCALES (See also object of measurement)

SCALES, Antimony Test
Howe Scale Co.
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Automatic
Automatic Scale Co.
Buffalo Scale Co.
Chatillon & Sons
Exact Weight Scale
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co., Inc.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.
Triangle Package Mach.
Triner Sales Co.

SCALES, Bag Filling
Automatic Scale Co.
Exact Weight Scale Co.
Fairbanks, Moore & Co.
Gump Co.
Jacobs Bros. Co.
Kron Co.
Richardson Scale Co.
Syntron Company
Toledo Scale Co.
Triangle Package Mach.

SCALES, Basis Weight
Amthor Testing Inst. Co.
Becker, Inc., Christian
Buffalo Scale Co.
Exact Scale Co.
Howe Scale Co.
Kron Co.
Seederer-Kohlbusch
Thwing-Albert Instrument
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Bulk Weighing
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Merrick Scale Mfg.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALE, Cement Batching
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Checking
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Jacobs Bros. Co., Inc.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

For addresses, see pages 66-76

SCALES, Classifying
Exact Weight Scale Co.
Jacobs Bros. Co., Inc.
Kron Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Computing
Amthor Testing Inst.
Exact Weight Scale
International Bus. Mach.
Jacobs Bros., Inc.
Toledo Scale Co.
Triner Sales Co.

SCALES, Continuous Weighing
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Jacobs Bros. Co.
Jeffrey Mfg. Co.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Syntron Company
Toledo Scale Co.
Triangle Package Mach.
United Cinephone Corp.

SCALES, Conveyor
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Counting
Amthor Testing Inst. Co.
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Kron Co.
Seederer-Kohlbusch
Toledo Scale Co.
Triner Sales Co.
United Cinephone Corp.

SCALES, Crane
Buffalo Scale Co.
Chatillon & Sons
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.

SCALES, Dairy
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Jacobs Bros. Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.
Troemner, Henry

SCALES, Differential
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Jacobs Bros. Co., Inc.
Kron Co.
Thwing-Albert Instrument

SCALES, Drawing (See Drawing Instruments)

SCALES, Dump
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Toledo Scale Co.

SCALES, Dynamometer
Central Scientific Co.
Chatillon & Sons
Dillon & Co.
Exact Weight Scale
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Martin Decker Corp.
Seederer-Kohlbusch, Inc.
Toledo Scale Co.

SCALES, Estimating
Exact Weight Scale Co.
Jacobs Bros. Co.
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Grain & Seed Testing
Amthor Testing Inst. Co.
Automatic Scale Co.
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Fisher Scientific Co.
Gump Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Newark Scale Works
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALES, Hopper
Buffalo Scale Co.
Chatillon & Sons
Exact Weight Scale
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Jacobs Bros. Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Laboratory
Becker, Inc., Christian
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Chicago Apparatus Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Fisher Scientific Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Jacobs Bros. Co.
Microchemical Service
Newark Scale Works
Seederer-Kohlbusch, Inc.
Toledo Scale Co.
Torsion Balance Co.
Troemner, Henry

SCALES, Larry Car
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Liquid
Jacobs Bros. Co., Inc.
Richardson Scale Co.

SCALES, Loss of Weight
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Jacobs Bros. Co.
Kron Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.

SCALES, Measuring
Automatic Scale Co.
Howe Scale Co.
Kron Co.
Richardson Scale Co.
Triner Sales Co.

SCALES, Over & Under
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Moisture Register Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.
Troemner, Henry

SCALES, Packaging
Automatic Scale Co.
Becker, Inc., Christian
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Kron Co.
International Bus. Mach.
Jacobs Bros. Co.
Pneumatic Scale Corp.
Richardson Scale Co.
Toledo Scale Co.
Torsion Balance Co.
Triangle Package Mach.
Triner Sales Co.
Troemner, Henry

SCALES, Platform
Becker, Inc., Christian
Buffalo Scale Co.
Chatillon & Sons
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
Humboldt Mfg. Co.
International Bus. Mach.
Knowles Scale Works
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Portable
Black & Decker
Buffalo Scale Co.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale
Fairbanks, Morse & Co.
Gump Co.
Howe Scale Co.
International Bus. Mach.
Jacobs Bros. Co.
Knowles Scale Works
Kron Co.
Richardson Scale Co.
Toledo Scale Co.
Triner Sales Co.

SCALES, Predetermined Weight
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.

(Cont'd)

SCALES, Predetermined Weight (Continued)
Jacobs Bros. Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Schaffer Poidometer Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Recording
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Merrick Scale Mfg. Co.
Richardson Scale Co.
Streeter-Amet Co.
Toledo Scale Co.
Wallace & Tiernan

SCALES, Remote Indicating
Toledo Scale Co.

SCALES, Rolling Mill
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Sacking (See Scales, Bag-filling)

SCALES, Selecting
Exact Weight Scale
Toledo Scale Co.
United Cinephone Corp.

SCALES, Solder Test
Central Scientific Co.
Exact Weight Scale
Seederer-Kohlbusch, Inc.
Troemner, Henry

SCALES, Steel
Exact Weight Scale
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Lufkin Rule Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Testing
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale
Gump Co.
Howe Scale Co.
Humboldt Mfg. Co.
Jacobs Bros. Co.
Kron Co.
Newark Scale Works
Toledo Scale Co.
Torsion Balance Co.

SCALES, Textile
Becker, Inc., Christian
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Saxl Instrument Co.
Seederer-Kohlbusch, Inc.
Streeter-Amet Co.
Suter, Alfred
Toledo Scale Co.
Torsion Balance Co.
Triner Sales Co.

SCALES, Track
Buffalo Scale Co.
Fairbanks, Morse & Co.
Howe Scale Co.
Kron Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Truck
Black & Becker
Buffalo Scale Co.
Exact Weight Scale Co.
Fairbanks, Morse & Co.
Streeter-Amet Co.
Toledo Scale Co.

SCALES, Water Meter
Altender & Sons
Exact Weight Scale
Fairbanks, Morse & Co.
Jacobs Bros. Co.
Kron Co.
Toledo Scale Co.

SCALES, Yardage
Amthor Testing Inst.
Brown & Sharpe
Buffalo Scale Co.
Exact Weight Scale
Fairbanks, Morse & Co.
Howe Scale Co.
International Bus. Mach.
Kron Co.
Toledo Scale Co.

SCREENS, Solar Projecting
Fecker, J. W.

SCREENS, X-Ray Fluoroscopic
General Electric X-Ray
Kelley-Koett Mfg. Co.
Patterson Screen Co.
Westinghouse X-Ray Co.

SCREENS, X-Ray Intensifying (See Screens X-Ray Fluoroscopic)

SEED SIEVE SETS
Ballauf Mfg. Co.

SEGER CONES (See Cones, Pyrometric)

SEISMOGRAPHS
Akatos, Inc.
Alpha Instrument Co.
American Inst. Co.
Am. Telescope Labs.
Engineering Labs., Inc.
Geophysical Instrument
Heiland Research Corp.
Macs Instrument Co.
Miller Corp., Wm.
Ruska & Co., Inc.

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Am. Automatic Elec.
American Inst. Co.
Area Regulators, Inc.
Bailey Meter Co.
Betts & Betts
Brown Inst. Co.
Cutler-Hammer, Inc.
D'Este Co.
Dickson Co.
Elec. Indicator Corp.
Hanlon-Waters, Inc.
Lammert & Mann Co.
Leeds & Northrup Co.
Leslie Co.
Mason-Neilan Regulator
Minneapolis-Honeywell
Partlow Corp.
Penn Electric Switch Co.
Perfex Corp.
Ruggles-Klingemann
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
United Transformer

SERVO-MOTORS, Electric Motor
Brown Inst. Co.
Eclipse Aviation
General Regulator Corp.
L. A. B. Corp.
Minneapolis-Honeywell

SERVO-MOTORS, Electric Solepoid
Brown Inst. Co.
Eclipse Aviation
Ruggles-Klingemann

SERVO-MOTORS, Hydraulic
Allis-Chalmers Mfg. Co.
Askania Regulator Co.
Eclipse Aviation
General Regulator Corp.
Hagan Corp.
Mason-Neilan Regulator
Ruggles-Klingemann

SERVO-MOTORS, Mechanical
Hagan Corp.

SERVO-MOTORS, Pneumatic
Askania Regulator Co.
Brown Inst. Co.
Hagan Corp.
Mason-Neilan Regulator
Minneapolis-Honeywell

SEXTANTS
Alpha Instrument Co.
Bausch & Lomb Opt.
Keuffel & Esser Co.
Kuhner Co., Max
Master Optical Co.
Negus, T. S. & J. D.
Pioneer Instrument Co.
Warren-Knight Co.
White Co., Inc.

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Kenyon Instrument Co.
Negus, T. S. & J. D.
Pitometer Log Corp.

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General Elec. Co.
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Rawson Electrical Inst.
Roller-Smith Co.
Rubicon Co.
Sensitive Research Inst.
Triplett Electrical Inst.
Westinghouse Elec. & Mfg.
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SHUNTS, Standard
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Esterline-Angus Co.
General Electric Co.
Gray Instrument Co.
Hickok Electrical Inst.
Instrument Resistors, Inc.
International Resistance
Leeds & Northrup Co.
Roller-Smith Co.
Rubicon Co.
Triplett Elec. Inst. Co.
Weston Elec. Inst. Corp.

SIEVE SHAKERS
Braun Corp.

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Central Scientific Co.
Dietert Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Riehle Division
Scientific Inst. Co.
Weber Brothers Metal

SIGHT METERS
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G-M Labs.
Weston Elec. Inst. Corp.

SIGHTS, GUN Telescopic
Bausch & Lomb Opt.
Clark & Sons
Fecker, J. W.
Kollmorgen Optical Co.
Perkin-Elmer Corp.
Zeiss, Inc., Carl

SIGNAL GENERATORS (See Generators, Signal)

SIGNALING DEVICES, Automatic
American Automatic Elec.
Autocall Co.
Betts & Betts
Bullard Co.
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Elec. Indicator Corp.
Foxboro Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Holtzer-Cabot Elec. Co.
International Bus. Mach.
Leslie Co.
Production Instrument
Spence Engineering Co.
Thompson Clock Co.
United Cinephone Corp.

SIGNALING DEVICES, Traffic
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Bullard Co.
Eagle Signal Corp.
Edison Electrical Controls
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SILICA, VITREOUS
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SLIDING GAGES (See Gages, Sliding)

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Annis Co.
Boulin Instrument Corp.
Commercial Engg. Labs.
Warren Telechron Co.

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Boiler Room Equip.
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Denver Fire Clay Co.
Dickson Co.
Electronic Lab.
Ess Instrument Co.
General Elec. Co.
General Television Corp.
Leeds & Northrup Co.
Lumenite Elec. Co.
Luxtrol Co., Inc.
McNeill Eng. Equip.
Photobell Corp.
Photoswitch, Inc.
Preferred Utilities Mfg.
Rehtron Corp.
United Cinephone Corp.
Weston Elec. Inst. Corp.

SOLAR PROJECTING SCREEN (See Screen, Solar Projecting)

SOUND INDICATORS & ANALYZERS (See Indicators, Sound & Analyzers, Sound)

SOUND LEVEL METERS
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Clough-Brengle Co.
Daven Co.
De Jur-Amsco Corp.
Electrical Research Prod.
Electronic Design Corp.
General Elec. Co.
General Radio Co.
Jones-Orme Co.
Precision Apparatus Corp.
Radio City Products Co.
Shallcross Mfg. Co.
Sound Apparatus Co.
Triplett Electrical Inst.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

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Bliss & Co.
Kenyon Instrument Co.
Kuhner Co., Max
Moeller Instrument Co.
Negus, T. S. & J. D.

SOUNDING MACHINES
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Bendix Marine Products
Kenyon Instrument Co.
Kuhner Co., Max
Moeller Instrument Co.
Negus, T. S. & J. D.
Submarine Signal Co.

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Ballauf Mfg. Co.
Kimble Glass Co.
Moeller Instrument Co.
Negus, T. S. & J. D.

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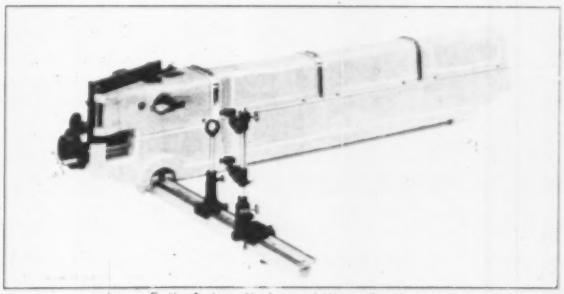
Bailey Meter Co.
Binckley G. S.
Eimer & Amend
Foxboro Co.
Refinery Supply Co.
G. M. Mfg. Co.
Moeller Inst. Co.
Rochtel Co.
Schultheis Corp.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Trerice Co.



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For addresses, see pages 66-76

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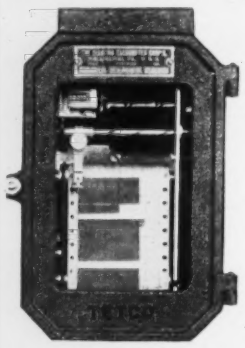

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Eastern Science Co.
Fuess, Inc.
Gaertner Scientific Corp.

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SPECTROGRAPHS
Akatos, Inc.
Baird Associates
Bausch & Lomb Optical
Bryden Co.
Gaertner Scientific Corp.
Spencer Lens Co.
Zeiss, Inc., Carl

SPECTROGRAPHS, Diffraction Grating
Applied Research Labs.
Baird Associates

SPECTROGRAPHS, Oscillating
Hayes Scientific App.

SPECTROGRAPHS, Vacuum
Central Scientific Co.
Dietert Co.
Fecker, J. W.
Fuess, Inc.
Jarrell-Ash Co.

SPECTROGRAPHS, X-ray
Central Scientific Co.
Fuess, Inc.
Gaertner Scientific
General Electric X-Ray
Hayes Scientific App.
Jarrell-Ash Co.
Kelley-Koett Mfg.

SPECTROMETERS
Akatos, Inc.
American Askania Corp.
Bausch & Lomb Optical
Fuess, Inc.
Jarrell-Ash Co.
Spencer Lens Co.

SPECTROMETER, Infra-Red
Gaertner Scientific Corp.

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Akatos, Inc.
American Askania Corp.
Bausch & Lomb Opt.
Fuess, Inc.
Gaertner Scientific Corp.
Laboratory Specialties
Leitz, Inc.
Spencer Lens Co.

SPECTROSCOPE, Quartz
Gaertner Scientific Corp.

SPECTROSCOPES, Stellar
Am. Telescope Labs.
Central Scientific Co.
Eastern Science Co.
Fecker, J. W.
Mico Instrument Co.
Perkins-Elmer Corp.
Zeiss, Inc., Carl

SPECTRUM TUBES
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Fuess, Inc.
Gaertner Scientific Corp.
General Physical Lab.
Jarrell-Ash Co.

SPEED, Indicators
Amthor Testing Inst. Co.
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Biddle Co., Jas. G.
Boulin Instrument Corp.
Brown Inst. Co.
Commercial Engg. Labs.
Consol. Ashcroft Hancock
Cramer & Co., Inc.
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Elec. Tachometer Corp.
Esterline-Angus Co.
Foxboro Co.
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Hasler-Tel Co.
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Hickok Elec. Inst. Co.
Jaeger Watch Co.
Leeds & Northrup Co.
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Pioneer Instrument
Precision Therm. & Inst.
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Sound Apparatus Co.
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Weston Elec. Inst. Corp.
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SPEED, Regulators (See Controllers, Automatic, Tachometric)

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SPEEDOMETERS
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General Elec. Co.
Knopf, Paul
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Ferner Co.
Fish-Schurman Co.
Fuess, Inc.
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Merkle Korff Gear
Selsi Co., Inc.
Welch Scientific Co.

SPHYGMOMANOMETERS
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Central Scientific Co.
Hellige, Inc.
Taylor Inst. Cos.

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Brown & Sharpe
Lufkin Rule Co.
Mico Instrument Co.
Starrett Co.
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STANDARDS, Capacitance
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General Radio Co.
Industrial Instruments
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Rubicon Co.
Solar Mfg. Corp.

STANDARDS, Color
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Hellige, Inc.
Munsell Color Co.
Tagliabue Mfg. Co.

STANDARDS E.m.f.
Cambridge Inst. Co.
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Frequency
Andrew Victor J.
Ferris Inst. Corp.
General Radio Co.

STANDARDS, Inductance
Cambridge Inst. Co.
General Radio Co.
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Length
Gaertner Scientific Corp.
Gurley, W. & L. E.
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STANDARDS, Mass
Gurley, W. & L. E.
Seederer-Kohlbusch, Inc.

STANDARDS, Potential
Leeds & Northrup Co.
Rubicon Co.

STANDARDS, Pressure
Green, Henry J.
Precision Therm. & Inst.

STANDARDS, Resistance
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Cambridge Inst. Co.
General Radio Co.
International Resistance
Leeds & Northrup Co.
Rubicon Co.
Shallcross Mfg. Co.
Sticht & Co.
Ward Leonard Elec. Co.

STANDARDS, Sound Level
General Radio Co.

STANDARDS, Temperature
Green, Henry J.
Leeds & Northrup Co.
Moeller Instrument Co.
Precision Therm. & Inst.
Tagliabue Mfg. Co.

STANDARDS, Time
Gaertner Scientific Corp.
General Radio Co.
Standard Elec. Time Co.

STANDARDS, Volume
Gurley, W. & L. E.

STARTERS, MOTOR
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Allis-Chalmers Mfg. Co.
Cutler-Hammer, Inc.
Eclipse Aviation
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Monitor-Controller Co.
Penn Electric Switch Co.
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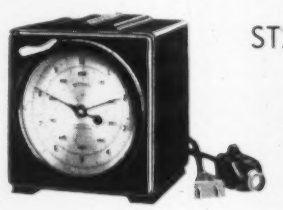

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For addresses, see pages 66-76

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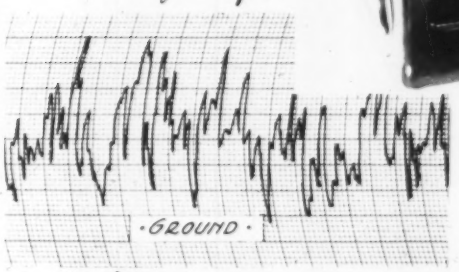

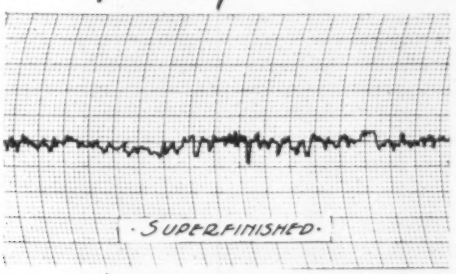

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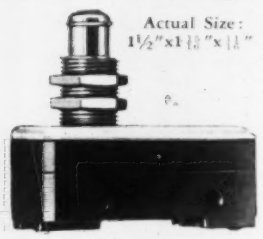

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Portable Tachometer

Multi-range indicator and generator combined in compact hand piece for general shop use.

Conventional Types

For permanent installation. Calibrated to suit your requirements. LOW COST widens field of application.

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STEAM METERS (See Flow Meters, Steam)
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STELLAR SPECTROSCOPES (See Spectroscopes, Stellar)
STEREOSCOPES, X-Ray
Bausch & Lomb Optical
Kelley-Koett Mfg. Co.
Westinghouse X-Ray Co.
STETHOSCOPES, ENGINEERS
Brush Development Co.
Test-A-Tone Co.
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STILLS, AUTOMATIC WATER
Barnstead Still & Steril
Central Scientific Co.
Fish-Schurman Co.
Specialty Glass Co.
Weber Bros. Metal Works
STIRRERS, LABORATORY, Variable Speed
Eastern Engg. Co.
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Brown & Sharpe
Dietzen Co.
Ford Motor Co.
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Soltmann, Inc.
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Warren-Knight Co.
White Co. Inc.
STRAIGHTENING VANES
Robinson Orifice Fitting
STRAIN GAGES (See Gages, Strain)
STRAIN TESTERS, GLASS (See Testers, Strain (Glass)
STRAIN-TIME RECORDERS
Baldwin-Southwark Corp.
Cambridge Inst. Co.
STREAM GAGING INSTRUMENTS
Gurley, W. & L. E.
Keuffel & Esser Co.
Morey & Jones, Ltd.
STRESS INDICATORS
Ames Co., B. C.
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Martin Decker Corp.
Riehle Div.
STRESS-STRAIN, Indicators
Ames Co., B. C.
Baldwin-Southwark Corp.
STRESS-STRAIN, Recorders
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Olsen Testing Machine
Riehle Div.
STROBOSCOPES
Boulin Inst. Corp.
Commercial Engg. Labs.
L. A. B. Corp.
Pioneer Instrument
Welch Mfg. Co.
Westinghouse Elec. & Mfg.
Zeiss, Inc., Carl
SULPHUR BOMBS (See Bombs, Su'phur)
SULPHUR DIOXIDE, Indicators (See Gas Analyzers, Sulphur Dioxide) **Recorders** (See Gas Analyzers, Sulphur Dioxide)
SUNSHINE, Indicators & Recorders
Cambridge Inst. Co.
Esterline-Angus Co.
Friez & Sons
Fuess, Inc.
G. M. Mfg. Co., Inc.
Leeds & Northrup
Luxtrol Co., Inc.
Taylor Inst. Cos.
White Co. Inc.
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American Automatic Elec.
Autocall Co.
Bristol Co.
Cramer & Co., Inc.
General Elec. Co.
Guardian Elec. Mfg. Co.
Leeds & Northrup Co.
Tagliabue Mfg. Co.
SURFACE FINISH TESTERS
Brush Development Co.
Physicists Research
SURFACE GAGES (See Gages, Surface)
SURFACE PLATES, GLASS
Bausch & Lomb Optical
Clark & Sons
Fowler, J. W.
Fish-Schurman Co.
Zeiss, Inc., Carl
SURGE CREST AMMETERS (Ammeters, Surge-Crest)
SURGE, Indicators & Recorders
Elec. Indicator Corp.
General Elec. Co.
Esterline-Angus Co.
SURVEYING INSTRUMENTS
Alpha Instrument Co.
Beckman Co.
Berger & Sons
Bliss & Co.
Bostrom-Brady
Dietzen Co.
Goldak Co.
Gurley, W. & L. E.
Kenyon Instrument Co.
Kern Co.
Keuffel & Esser Co.
Kolesch & Company
Leunold, Volpel & Co.
Pittsburgh Inst. & Mach.
Post Co., Frederick
Speedometer Electric Co.
Speidel & Co.
J. C. Ulmer Co.
United States Blue Print
Warren-Knight Co.
Weber Co.
White Co. Inc.
Zeiss, Inc., Carl
SURVEYING INSTRUMENTS, Aneroids
Am. Paulin System
SURVEYING INSTRUMENTS, Underground, for wells or bore holes
H. Cole Co.
Driftmeters, Inc.
Engineering Labs., Inc.
Geophysical Inst. Co.
Halliburton Oil Well
Ruska & Co.
Sperry-Sun Well Survey
Warren-Knight Co.
David White Co. Inc.
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SWITCHES, Air-operated
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Johnson Service Co.
Shallcross Mfg. Co.
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SWITCHES, Automatic Transfer
Allen-Bradley Co.
Anderson, A. & J. M.
Arrow-Hart & Hegeman
Autocall Co.
Automatic Switch Co.
Cramer & Co., Inc.
Cutler-Hammer, Inc.
General Elec. Co.
Hart Mfg. Co.
Monitor Controller Co.
Ward Leonard Elec. Co.
Zenith Electric Co.
SWITCHES, Instrument
Autocall Co.
Furnas Electric Co.
General Elec. Co.
J-B-L Inst. Co.
Kellogg Switchboard
Micro Switch Corp.
Rubicon Co.
Sensitive Research Inst.
Thwing-Albert Instrument
Trinlett Elec. Inst. Co.
United States Inst. Corp.
Weston Elec. Inst. Corp.
SWITCHES, Magnetic
Allen-Bradley Co.
Arrow-Hart & Hegeman
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Industrial Engr. Corp.
Monitor Controller Co.
Penn Electric Switch
Perfex Corp.
Struthers-Dunn
Ward Leonard Elec. Co.
Zenith Electric Co.
SWITCHES, Mercury
Arrow-Hart & Hegeman
Continental Elec. Co.
Elec. Switch Corp.
Frederick, George
General Elec. Co.
Gen. Elec. Lamp Dept.
Hart Mfg. Co.
Minneapolis-Honeywell
SWITCHES, Pyrometer
J-B-T Insts. Inc.
Lewis Engg. Co.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Weston Elec. Inst. Corp.
Woermann-Schuchhardt
SWITCHES, Relay
Allen-Bradley Co.
Andrew, Victor J.
Amer. Automatic Elec.
Arrow-Hart & Hegeman
Autocall Co.
Automatic Switch Co.
Cutler-Hammer, Inc.
Eclipse Aviation
Edison Electrical Controls
Friez & Sons
General Controls Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Industrial Engr. Corp.
Kellogg Switchboard
Monitor Controller Co.
Penn Electric Switch
Perfex Corp.
Standard Elec. Prods.
Struthers-Dunn
Ward Leonard Elec. Co.
Zenith Electric Co.
SWITCHES, Rotary
Amer. Automatic Elec.
Arrow-Hart & Hegeman
Autocall Co.
Furnas Electric Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Hart Mfg. Co.
Lewis Engg. Co.
Ruhicon Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.
SWITCHES, Snap
Arrow-Hart & Hegeman
Cutler-Hammer, Inc.
General Elec. Co.
Hart Mfg. Co.
McDonnell & Miller
Micro Switch Corp.
Minneapolis-Honeywell
Perfex Corp.
Ward Leonard Elec. Co.
SWITCHES, Thermostatic
Advance Electric Co.
Allen-Bradley Co.
Burling Instrument Co.
Cook Electric Co.
Detroit Lubricator Co.
Dunn, Inc., Struthers
Edison Electrical Co.
Friez & Sons
Gleason-Avery, Inc.
Guardian Electric
Hart Manufacturing Co.
Minneapolis-Honeywell
Penn Electric Switch Co.
Perfex Corp.
Shallcross Mfg. Co.
Spencer Thermostat Co.
Tagliabue Mfg. Co., C. J.
Ulanet Co., George
Ward Leonard Electric Co.
SWITCHES, Time
American Timer Corp.
Anderson, A. & J. M.
Autocall Co.
Automatic Elec. Mfg.
Bacon, Emra D.
Cramer & Co., Inc.
Eagle Signal Corp.
Edison Electrical Controls
Frober-Faybor Co.
General Elec. Co.
Guardian Elec. Mfg. Co.
Industrial Engr. Corp.
Industrial Instrument Co.
Landis & Gyr, Inc.
Minneapolis-Honeywell
Paragon Electric Co.
Penn Electric Switch
Perfex Corp.
Rhodes, Inc., M. H.
Sangamo Electric Co.
States Co.
Thomas Clock Co., Seth
Thompson Clock Co.
Wadsworth Elec. Mfg. Co.
Walser Automatic Timer
Ward Leonard Elec. Co.
Zenith Electric Co.
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SYNCHRONOUS MOTORS (See Motors, Synchronous)
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Allis-Chalmers Mfg. Co.
Eclipse Aviation
Electric Controller
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Hickok Elec. Inst. Co.
Kollsman Inst. Co.
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Amthor Testing Inst.
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Cramer & Co., Inc.
Olmer Register Co.
Zeiss, Inc., Carl
Zernickow Co., O.
TACHOMETER TESTERS (See Testers, Tachometer)
TACHOMETERS, Centrifugal
Amthor Testing Inst. Co.
Bartgur Stockwell Co.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Coats Mach. Tool Co.
Consol. Ashcroft Hancock
Corbin Screw Corp.
Durant Mfg. Co.
Elec. Tachometer Corp.
Foxboro Co.
Hays Corp.
Jones, Noreola Sales
Knopf, Paul
Kollsman Inst. Co.
Pioneer Instrument Co.
Scherr Co., Inc.
Stewart-Warner Corp.
Sticht & Co.
Veeder-Root, Inc.
Viking Instrument Co.
Zernickow Co., O.
TACHOMETERS, Chronometric
Amthor Testing Inst.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Coats Mach. Tool Co.
Cramer & Co., Inc.
Elec. Tachometer Corp.
Elgin Nat'l Watch Co.
Hasler-Tel Co.
Jaeger Watch Co.
Pierce Watch Co.
Scherr Co., Inc.
Standard Elec. Time
Sticht & Co.
Stover-Lang Co.
Zernickow Co., O.
TACHOMETERS, Cross-pendulum
Amthor Testing Inst.
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Sticht & Co.
Zernickow Co., O.
TACHOMETERS, Electric
Bristol Co.
Brown Inst. Co.
Electric Speed Ind. Co.
Elec. Tachometer Corp.
Esterline-Angus Co.
Foxboro Co.
General Elec. Co.
Hathaway Inst. Co.
Hickok Elec. Inst. Co.
Hy-Ef Electrical Prod.
(Cont'd)

For addresses, see pages 66-76

HOMETERS, Electric (Continued)
Hagan Watch Co.
H-F Instruments
Jones Motrola Sales
Kollsman Inst. Co.
Lewis Phelps Corp.
Martin Decker Corp.
Pressure Register Co.
Rational Instrument Co.
Sigmet Instrument Co.
Stromberg Log Corp.
Sutter Co.
Scherr Co., Inc.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.
Winslow Co.
Zip Abrasive Co.

TACHOMETERS, Electro-magnetic
Cummings Mach. Works
Dreyer Watch Co.
Kollsman Inst. Co.
National Instrument Co.
Pioneer Instrument
Standard Elec. Time Co.
Stewart-Warner Corp.
Zernickow Co., O.

TACHOMETERS, Fly-ball
Biddle Co., Jas. G.
Coats Mach. Tool Co.
Elec. Tachometer Corp.
Jones Motrola Sales
Sticht & Co.
Viking Instrument Co.

TACHOMETERS, Portable
Amthor Testing Inst. Co.
Biddle Co., Jas. G.
Boulin Instrument Corp.
Consol. Ashcroft Hancock
Corbin Screw Corp.
Elec. Tachometer Corp.
Foxboro Co.
Hasler-Tel Co.
Jones Motrola Sales
Martindale Electric Co.
Rieker Instrument Co.
Sticht & Co.
Viking Instrument Co.
Zernikow Co.

TACHOMETERS, Speed Limit Control
Barbour Stockwell Co.

TACHOMETERS, Stroboscopic
Boulin Instrument Corp.
Coats Mach. Tool
General Radio Co.
L. A. B. Corp.
Stewart-Warner Corp.

TACHOMETERS, Tilting-ring
Amthor Testing Inst. Co.
Coats Mach. Tool Co.
Zernikow Co.

TACHOMETERS, Vibrating Reed
Biddle Co., Jas. G.

TACHOSCOPES
Amthor Testing Inst. Co.
Biddle Co., Jas. G.
Scherr Co., Inc.
Sticht & Co.
Zernickow Co., O.

TAFFRAIL LOGS; SHIP
Bliss & Co.

TANGENT METERS (See Meters, Tangent)

TAPE STRETCHER APPARATUS
Ballauf Mfg. Co.

TAPES, Oil Gauger's
Keuffel & Esser Co.

TAPES, Steel
Dietzen Co.
Keuffel & Esser Co.
Lufkin Rule Co.
Soltmann, Inc.
Speidel & Co.
Starrett Co.
United States Blue Print
Warren-Knight Co.
Weber Co.
White Co., Inc.

TAPES, Surveyor's (See Surveying Instruments)

TAXI METERS
Knopf, Paul
Ohmer Register Co.
Pittsburgh Taximeter Co.

TELEMETERING SYSTEMS (See Remote Metering)

TELEMETERS (Surveying & Military—Optical)
Kern Co.
Kollmorgen Optical Co.
Keuffel & Esser Co.
Pierce Watch Co.

TELESCOPES, Alignment
Am. Telescope Labs.
Fecker, J. W.
Gen. Engg. & Model
Keuffel & Esser Co.
Kollmorgen Optical Co.
Perkin-Elmer Corp.
Scherr Co., Inc.
Unertl, John
White Co., Inc.

TELESCOPES, Astronomical
Am. Telescope Labs.
Bausch & Lomb Opt.
Clark & Sons
Eastern Science Co.
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Micro Instrument Co.
Perkin-Elmer Corp.
Tinsley Labs.
Unertl, John
Zeiss, Inc., Carl

TELESCOPES, Azimuth
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Kollmorgen Optical Co.
Perkin-Elmer Corp.
Tinsley Labs.
Unertl, John
Warren-Knight Co.
Warner & Swasey Co.
Zeiss, Inc., Carl

TELESCOPES, Bore, Inspection
Am. Telescope Labs.
Gen. Engg. & Model Wks.
Kollmorgen Optical Co.
Lenox Inst. Co.
Perkin-Elmer Corp.
Scherr Co., Inc.
Unertl, John
Zeiss, Inc., Carl

TELESCOPES, Laboratory
Gaertner Scientific Corp.

TELESCOPES, Reflecting
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Perkin-Elmer Corp.
Tinsley Labs.
Unertl, John
Warner & Swasey Co.
Zeiss, Inc., Carl

TELESCOPES, Refracting
Am. Telescope Labs.
Bausch & Lomb Opt.
Clark & Sons
Fecker, J. W.
Fish-Schurman Co.
Kern Co.
Keuffel & Esser Co.
Perkin-Elmer Corp.
Tinsley Labs.
Unertl, John
Warner & Swasey Co.
Wollensak Optical Co.
Zeiss, Inc., Carl

TELESCOPES, Zenith
American Askania Corp.
Am. Telescope Labs.
Clark & Sons
Fecker, J. W.
Gaertner Scientific Corp.
Kern Co.
Perkin-Elmer Corp.
Unertl, John
Zeiss, Inc., Carl

TENSIOMETERS
Boulin Instrument Corp.
Central Scientific Co.
Geophysical Inst. Co.
Olsen Testing Machine
Suter, Alfred
Thwing-Albert
Toledo Scale Co.

TENSION INDICATORS
Martin Decker Corp.
Pacific Scientific Co.
Seederer-Kohlbusch, Inc.

TENSION INDICATORS, Textile
Boulin Instrument Corp.

TEST BLOCKS
Detroit Testing Mach. Co.
Ford Motor Co.
Meter Devices Co.
Steel City Testing Lab.
Van Keuren Co.

TEST INDICATOR
Deming Indicator Co.

TEST WEIGHTS (See Weights, Test)

TEST WELLS
Palmer Co.

TESTERS, Tachometer
Rieker Inst. Co.

TESTERS & TESTING MACHINES (See also object of measurement and control)

TESTERS & TESTING MACHINES, Abrasion
American M. A. N. Corp.
Amthor Testing Inst. Co.
Atlas Elec. Devices Co.
Fidelity Mach. Co.
Morehouse Machine Co.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Shawmut Engineering Co.
Suter, Alfred
Taber Instrument Co.
Testing Machines, Inc.
Welch Engineering Co.
Zuhr, Inc., Henry

TESTERS & TESTING MACHINES, Absorption
Gurley, W. & L. E.

TESTERS & TESTING MACHINES, Air Speed Indicator (See Air-speed Indicator Testers)

TESTERS & TESTING MACHINES, Alternating Stress
American M. A. N. Corp.
Brush Development Co.
Emery Co.
Krouse Fatigue Machine
Olsen Testing Machine
Riehle Div.
Suter, Alfred

TESTERS & TESTING MACHINES, Altimeter (See Altimeter Testers)

TESTERS & TESTING MACHINES, Armature
Ideal Commutator Dresser

TESTERS & TESTING MACHINES, Asphalt
American Inst. Co.
Atlas Electric Devices
Brabender Corp.
Braun Corp.
Central Scientific Co.
Chatillon & Sons
Exact Weight Scale
Fish-Schurman Co.
Fisher Scientific Co.
Humboldt Mfg. Co.
Philadelphia Thermometer
Precision Scientific Co.
Riehle Div.
Tagliabue Mfg. Co.
Victor Equipment Co.
Western Machinery Co.

TESTERS & TESTING MACHINES, Axle
Sperry Products, Inc.

TESTERS & TESTING MACHINES, Ball Bearing (See Testers, Bearing)

TESTERS & TESTING MACHINES, Battery
Burton-Rogers Co.
Clough-Brengle Co.
Hickok Elec. Inst. Co.
Hy-Ef Electrical Prods.
Instrument Specialties Co.
Lantz-Phelps Corp.
Lundquist Tool & Mfg.
Precision Therm. & Inst.
Rascher & Betzold
Rieker Inst. Co.
Ruth Glass Division
Testrite Instrument Co.
Weston Elec. Inst. Corp.

TESTERS & TESTING MACHINES, Beating
Brabender Corp.
Green, Arthur B.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Bearing
American M. A. N. Corp.
Olsen Testing Machine
RCA Manufacturing Co.
Suter, Alfred

TESTERS & TESTING MACHINES, Bending
American M. A. N. Corp.
Dorr-Patterson Engr.
Hayes Scientific App.
Olsen Testing Machine
Holz, Herman A.
Morehouse Machine Co.
Riehle Div.
Saxl Inst. Co.
Steel City Testing Lab.
Suter, Alfred
Taber Instrument Co.
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Brake
American Inst. Co.
Clough-Brengle Co.
Commercial Engg. Labs.
Cramer & Co., Inc.

TESTERS & TESTING MACHINES, Brinel:
Detroit Testing Mach.
Ferner Co.
Olsen Testing Machine
Pittsburgh Inst. & Mach.
Riehle Div.
Steel City Testing Lab.
Suter, Alfred
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Brittleness
Baldwin-Southwark Corp.
Riehle Div.
Saxl Instr. Co.

TESTERS & TESTING MACHINES, Bursting
Perkins & Son, Inc.
Scott Co., Henry L.
Suter, Alfred
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Cable
Amthor Testing Inst.
Atlas Electric Devices
Boulin Instrument Corp.
General Elec. Co.
Leeds & Northrup Co.
Martin Decker Corp.
Olsen Testing Machine
Riehle Div.
Scott Co., Henry L.
Shallcross Mfg. Co.
Suter, Alfred

TESTERS & TESTING MACHINES, Cement
American Inst. Co.
Baldwin-Southwark Corp.
Central Scientific Co.
Emery Co.
Exact Weight Scale Co.
Federal Pneumatic Sys.
Fisher Scientific Co.
Hayes Scientific App.
Humboldt Mfg. Co.
Olsen Testing Machine
Precision Scientific Co.
Refinery Supply Co.
Riehle Div.
Scientific Inst. Co.
Scott Co., Henry L.
Sodemann Heat & Power
Suter, Alfred
Western Machinery Co.

TESTERS & TESTING MACHINES, Chain
Detroit Testing Machine
Riehle Div.

TESTERS & TESTING MACHINES, Chlorine
Bushnell & Nevins
(Cont'd)

TESTING MACHINES, Chlorine (Cont'd)
Everson Mfg. Co.
Hellige, Inc.
Industrial Inst. Inc.
Rascher & Betzold
Taylor & Co., Inc.
Wallace & Tiernan

TESTERS & TESTING MACHINES, Coal (See Fuel below)

TESTERS & TESTING MACHINES, Coil (Electric)
Boonton Radio Corp.
Clough-Brengle Co.
Ideal Commutator Dresser
Industrial Insts. Inc.
Rubicon Co.

TESTERS & TESTING MACHINES, Color
Atlas Electric Devices Co.
Eimer & Amend
Fisher Scientific Co.
Gaertner Scientific Corp.
Luxtrol Co., Inc.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Compression
American M. A. N. Corp.
Baldwin-Southwark Corp.
Dorr-Patterson Engr. Co.
Emery Co.
Exact Weight Scale Co.
Ferner Co.
Olsen Testing Machine
Perkins & Son, Inc.
Potter Co.
Riehle Div.
Scott Co., Henry L.
Steel City Testing Lab.
Suter, Alfred
Toledo Scale Co.

TESTERS & TESTING MACHINES, Concrete (See Cement above)

TESTERS & TESTING MACHINES, Condenser
Aerovox Corp.
Clough-Brengle Co.
Electronic Design Corp.
Industrial Insts. Inc.
Jackson Electrical Inst.
Potter Co.
RCA Manufacturing Co.
Tobe Deutschmann Corp.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.

TESTERS & TESTING MACHINES, Creep
Gaertner Scientific Corp.
Instrument Specialties Co.
Olsen Testing Machine
Riehle Div.
Suter, Alfred

TESTERS & TESTING MACHINES, Damping
American M. A. N. Corp.
Baldwin-Southwark Corp.

TESTERS & TESTING MACHINES, Deflection, Light Wave
Gaertner Scientific Corp.
Van Keuren Co.

TESTERS & TESTING MACHINES, Dew Point
General Electric
Refinery Supply Co.

TESTERS & TESTING MACHINES, Diaphragms
Instrument Specialties

TESTERS & TESTING MACHINES, Dielectric Properties
American Transformer Co.
Associated Research, Inc.
Leeds & Northrup Co.
Miller Co., B. F.
Potter-Smith Co.

TESTERS & TESTING MACHINES, Ductility
Central Scientific Co.
Detroit Testing Mach.
Humboldt Mfg. Co.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Steel City Testing Lab.
Suter, Alfred

TESTERS & TESTING MACHINES, Electroplating (See Electroplating Solution Testing Apparatus)

TESTERS & TESTING MACHINES, Emulsion & Demulsibility
Central Scientific Co.
Eimer & Amend

TESTERS & TESTING MACHINES, Expansion
Brabender Corp.
Exact Weight Scale Co.
Ferner Co.
Gaertner Scientific Corp.

TESTERS & TESTING MACHINES, Fatigue
American M. A. N. Corp.
Baldwin-Southwark Corp.
Emery Co.
Ferner Co.
Hathaway Inst. Co.
Hays Scientific App.
Krouse Fatigue Mach.
Olsen Testing Machine
Raytheon Mfg. Co.
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Suter, Alfred
Testing Machines, Inc.
Zuhr, Inc., Henry

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Manufacturers of

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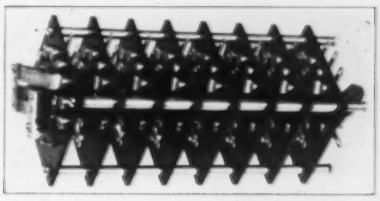
for

INSTRUMENT, ELECTRICAL AND INDUSTRIAL APPLICATIONS



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Central Scientific Co.
Ruehfel Co.

TESTERS & TESTING MACHINES, Flash Point, Abel-Pensky's (See Abel's above)

TESTERS & TESTING MACHINES, Flash Point, Cleveland Open Cup
American Inst. Co.
Bockel & Co.
Central Scientific Co.
Eimer & Amend
Humboldt Mfg. Co.
Olsen Testing Machine
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Flash Point, Elliott Closed Cup
American Inst. Co.
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Flash Point, Pensky-Martens
Bockel & Co.
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Flash Point, Tag Closed
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Flatness, Light Wave
Baird Associates
Fecker, J. W.
Fish-Schurman Co.
Gaertner Scientific Co.
Scherr Co., Inc.
Van Keuren Co.
Zeiss, Inc., Carl

TESTERS & TESTING MACHINES, Folding Endurance (Paper)
American Inst. Co.
Amthor Testing Inst. Co.
Olsen Testing Machine
Saxl Inst. Co.
Suter, Alfred
Testing Machines, Inc.
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Freeness
Dietert Co.
Green, Arthur B.
Testing Machines, Inc.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Fuel
Brabender Corp.
Burrell Technical Supply
Central Scientific Co.
Emerson Apparatus Co.
Fish-Schurman Co.
Fisher Scientific Co.
Parr Instrument Co.
Riehle Div.
Sargent & Co.

TESTERS & TESTING MACHINES, Gage (See Gage Testers)

TESTERS & TESTING MACHINES, Gas
American Meter Co.
Burrell Technical Supply
Central Scientific Co.
Connelly Iron Sponge
Eimer & Amend
Fish-Schurman Co.
Fisher Scientific Co.
Friez & Sons
Fuess, Inc.
Gow-Mac Instrument
Refinery Supply Co.
Ruska & Co., Inc.
Sargent & Co.

TESTERS & TESTING MACHINES, Gear
Morse Twist Drill
Scherr Co., Inc.

TESTERS & TESTING MACHINES, Glue
Central Scientific Co.
Eimer & Amend
Fish-Schurman Co.
Olsen Testing Machine
Saxl Inst. Co.

TESTERS & TESTING MACHINES, Grain
Central Scientific Co.
Exact Weight Scale
Gump Co.
Moist-O-Meter, Inc.
Moisture Register Co.
Newark Scale Works
Tagliabue Mfg. Co.
Toledo Scale Co.
Troemner, Henry

TESTERS & TESTING MACHINES, Grease (See Grease Testing Apparatus)

TESTERS & TESTING MACHINES, Grinding Wheel
Olsen Testing Machine

TESTERS & TESTING MACHINES, Ground Resistance
Biddle Co., Jas. G.
Geophysical Inst. Co.
Industrial Insts. Inc.
Sticht & Co.

TESTERS & TESTING MACHINES, Gummed Tape
Amthor Testing Inst.
Scott Co., Henry L.
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Hardness
Detroit Testing Mach.
Dietert Co.
Ferner Co.
Fisher Scientific Co.
Leitz, Inc.
Olsen Testing Machine
Pittsburgh Inst. & Mach.
Riehle Div.
Saxl Inst. Co.
Shore Instrument
Steel City Testing Lab.
Suter, Alfred
Teleweld, Inc.
Testing Machines, Inc.
Wilson Mech. Inst. Co.
Zeiss, Inc., Carl

TESTERS & TESTING MACHINES, Hardness of Grindable Materials
Brabender Corp.

TESTERS & TESTING MACHINES, Hardness of Plastic Films
Munsell Color Co.
Saxl Inst. Co.
Steel City Testing Lab.
Taber Instrument Co.
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Hydrogen-Ion (See Hydrogen Ion Determination Instruments)

TESTERS & TESTING MACHINES, Impact
Baldwin-Southwark Corp.
Cambridge Inst. Co.
Impact Register Co.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Steel City Testing Lab.
Testing Machines, Inc.
Thwing-Albert Inst.
Saxl Inst. Co.
Zuhr, Inc., Henry

TESTERS & TESTING MACHINES, Initial Tearing
Scott Co., Henry L.
Suter, Alfred
Testing Machines, Inc.
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Insulation
Associated Research
Biddle Co., Jas. G.
Clough-Brengle Co.
General Elec. Co.
General Radio Co.
Ideal Commutator Dresser
Industrial Insts. Inc.
Leeds & Northrup Co.
Martindale Electric Co.
Miller Co., Bertrand F.
Rawson Electrical Inst.
Rubicon Co.
Scott Co., Henry L.
Shallcross Mfg. Co.
Sticht & Co.
United Transformer Corp.

TESTERS & TESTING MACHINES, Insulation (Thickness)
Comtor Co.
General Elec. Co.
Instrument Specialties Co.

TESTERS & TESTING MACHINES, Jelly
Brabender Corp.
Chatillon & Sons
Fish-Schurman Co.
Saxl Inst. Co.

TESTERS & TESTING MACHINES, Knit Goods (See Textile below)

TESTERS & TESTING MACHINES, Leather
Amthor Testing Inst. Co.
Central Scientific Co.
Olsen Testing Machine
Perkins & Son
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.

TESTERS & TESTING MACHINES, Magnetic
Annis Co.
Associated Research
Baird Associates
Commercial Engg. Labs.
General Elec. Co.
Magnetic Analysis Corp.
Pioneer Instrument
Rawson Elec. Instr. Co.
Rubicon Co.

TESTERS & TESTING MACHINES, Malt
Brabender Corp.
Rieker Instrument Co.

TESTERS & TESTING MACHINES, Mileage (See Meters, Mileage)

TESTERS & TESTING MACHINES, Milk
Central Scientific Co.
Eimer & Amend
Munsell Color Co. Inc.
Rieker Inst. Co.
Ruehfel Co.
Ruth Glass Division
Scientific Glass App.
Testrite Instrument Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Moisture
Alpha-Lux Co.
American Inst. Co.
American Moistening Co.
Brabender Corp.
Brown Inst. Co.
Cambridge Inst. Co.
Central Scientific Co.
Delmhorst, Wm. J.
Dietert Co.
Eimer & Amend
Exact Weight Scale
Fisher Scientific Co.
Fuess, Inc.
Humboldt Mfg. Co.
Industrial Inst. Inc.
Moist-O-Meter, Inc.
Moisture Register Co.
Precision Scientific Co.
Rascher & Betzold
Refinery Supply Co.
Saxl Inst. Co.
Scientific Glass App.
Sci Inst. Co. (of Detroit)
Shallcross Mfg. Co.
Sodeman Heat & Power
Tagliabue Mfg. Co.
Testing Machines, Inc.
Thwing-Albert Inst. Co.
Toledo Scale Co.
Troemner, Henry
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Oil
American Inst. Co.
American M. A. N. Corp.
Brabender Corp.
Central Scientific Co.
Eimer & Amend
Fish-Schurman Co.
Hellige, Inc.
Humboldt Mfg. Co.
Mico Instrument Co.
Precision Scientific Co.
Rieker Inst. Co.
Ruehfel Co.
Ruska & Co.
Ruth Glass Division
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.
Western Machinery Co.

TESTERS & TESTING MACHINES, Oxygen
Burrell Technical Supply
Eimer & Amend
Sargent & Co.
Scientific Glass App.
Scientific Inst. Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Paint
Akatos, Inc.
Atlas Elec. Devices Co.
Central Scientific Co.
Fish-Schurman Co.
Munsell Color Co.
Ruehfel Co.
Saxl Instr. Co.
Scott Co., Henry L.
Taber Instrument Co.
Van Keuren Co.
Zuhr, Inc., Henry

TESTERS & TESTING MACHINES, Paper
American Inst. Co.
Amthor Testing Inst. Co.
Atlas Elec. Devices
Brown Inst. Co.
Central Scientific Co.
Eimer & Amend
Federal Prod. Corp.
Ferner Co.
Fuess, Inc.
Gurley, W. & L. E.
Instrument Specialties Co.
Olsen Testing Machine
Perkins & Son
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Speidel & Co.
Steel City Testing
Taber Instrument Co.
Toledo Scale Co.
Van Keuren Co.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Paper Formation
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Green, Arthur B.
Saxl Inst. Co.
Thwing-Albert Inst. Co.
Williams Apparatus Co.

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Perkins & Son
Ruehfel Co.
Tagliabue Mfg. Co.

TESTERS & TESTING MACHINES, Penetration (Paper)
Saxl Inst. Co.
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Thwing-Albert Inst. Co.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Petroleum (See Oil above)

TESTERS & TESTING MACHINES, Pipe & Tube
Baldwin-Southwark Corp.
Black & Decker
Olsen Testing Machine

TESTERS & TESTING MACHINES, Pistol Barrel Optical
Fuess, Inc.
Kollmorgen Optical Co.
Lenox Inst. Co.
Scherr Co., Inc.

TESTERS & TESTING MACHINES, Piston Ring

TESTERS & TESTING MACHINES, Pitch
American Inst. Co.
Precision Scientific Co.

TESTERS & TESTING MACHINES, Plasticity
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Brabender Corp.
Dietert Co.
Eimer & Amend
Olsen Testing Machine
Precision Scientific Co.
Saxl Inst. Co.
Scott Co., Henry L.
Steel City Testing
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Porosity
Fuess, Inc.
Gurley, W. & L. E.
Ruska & Co., Inc.
Saxl Inst. Co.
Testing Machines, Inc.
Williams Apparatus Co.

TESTERS & TESTING MACHINES, Pulp
Brabender Corp.
Perkins & Son
Testing Machines, Inc.
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TESTERS & TESTING MACHINES, Radio Set
Ferris Instrument Corp.
Hewlett-Packard
Hickok Electrical Inst.
Industrial Instruments
Measurements Corp.
Million Radio & Television
Monarch Manufacturing
Shallcross Mfg. Co.
Supreme Instrument Corp.
Triplett Electrical Inst.
Weston Electrical Inst.

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Sperry Products, Inc.

TESTERS & TESTING MACHINES, Resistance
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Biddle Co., James G.
Gray Instrument Co.
Industrial Instruments
Leeds & Northrup Co.
Million Radio & Tele.
Roller-Smith Co.
Shallcross Mfg. Co.
Supreme Instrument Corp.
Triplett Electrical Inst.
Weston Electrical Inst.

TESTERS & TESTING MACHINES Road Material (See Cement above)

TESTERS & TESTING MACHINES, Rubber
American Inst. Co.
Amthor Testing Inst.
Atlas Elec. Devices
Brabender Corp.
Central Scientific Co.
Eimer & Amend
Emerson Apparatus Co.
Federal Prod. Corp.
Ferner Co.
Fish-Schurman Co.
Link Eng. & Mfg.
Olsen Testing Machine
Morehouse Machine Co.
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Shore Instrument
Suter, Alfred
Steel City Testing
Van Keuren Co.

TESTERS & TESTING MACHINES, Sand
Chatillon & Sons
Dietert Co.
Eimer & Amend
Exact Weight Scale Co.
Humboldt Mfg. Co.
Koleseh & Company
Ruska & Co.

TESTERS & TESTING MACHINES, Scratch Hardness
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Saxl Inst. Co.
Spencer Lens Co.
Steel City Testing
Taber Instrument Co.
Testing Machines, Inc.

TESTERS & TESTING MACHINES, Shearing
Baldwin-Southwark Corp.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Suter, Alfred

TESTERS & TESTING MACHINES, Sheet Metal
Baldwin-Southwark Corp.
Bock Machine Co.
Detroit Testing Mach.
Emery Co.
Krouse Fatigue Machine
Olsen Testing Machine
Riehle Div.
Scott Co., Henry L.
Steel City Testing
Suter, Alfred
Taber Instrument Co.

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Saxl Inst. Co.
Testing Machines, Inc.
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TESTERS & TESTING MACHINES, Softness
Ferner Co.
Gurley, W. & L. E.
Humboldt Mfg. Co.
Saxl Inst. Co.
Taber Instrument Co.
Thwing-Albert Inst. Co.

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Chatillon & Sons
Detroit Testing Mach.
Emery Co.
Exact Weight Scale
Instrument Specialties Co.
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Saxl Inst. Co.
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Suter, Alfred
Toledo Scale Co.

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Suter, Alfred
Taber Instrument Co.
Thwing-Albert Inst. Co.
Toledo Scale Co.

TESTERS & TESTING MACHINES, Strain (Glass)
Akatos, Inc.
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Eimer & Amend
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Fuess, Inc.
Gaertner Scientific Corp.
General Elec. Co.
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Pfaltz & Bauer, Inc.
Polarizing Instrument Co.
Zeiss, Inc., Carl

TESTERS & TESTING MACHINES, Stretch
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Saxl Inst. Co.
Scott Co., Henry L.
Thwing-Albert Inst. Co.
Suter, Alfred

TESTERS & TESTING MACHINES, Tachometer
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Biddle Co., Jas. G.
Consol. Ashcroft Hancock
Elec. Tachometer Corp.
General Elec. Co.
Hayward, H. N.
Pioneer Instrument
Standard Elec. Time
Sticht & Co.
Zeiss, Inc., Carl
Zermickow Co., O.

TESTERS & TESTING MACHINES, Tearing-Paper
Saxl Inst. Co.
Scott Co., Henry L.
Speidel & Co.
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Tenderness
American Inst. Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Saxl Inst. Co.

TESTERS & TESTING MACHINES, Textile
American Inst. Co.
Atlas Elec. Devices Co.
Brown Inst. Co.
Perkins & Son
Saxl Inst. Co.
Scott Co., Henry L.
Suter, Alfred
Taber Instrument Co.
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Thermometer
Amthor Testing Inst.
Brown Inst. Co.
Consol. Ashcroft Hancock
Fuess, Inc.
G. M. Mfg. Co.
Green, Henry J.
Huddleston, J. S.
Moeller Instrument Co.
Ruehfel Co.
Schultheis Corp.
Tagliabue Mfg. Co.
Thwing-Albert Inst. Co.
Weksler Thermometer

TESTERS & TESTING MACHINES, Thread
Boulin Instrument Corp.
Holz, Herman A.
Saxl Inst. Co.
Scott Co., Henry L.
Suter, Alfred
Thwing-Albert Inst. Co.

TESTERS & TESTING MACHINES, Torsion
Baldwin-Southwark Corp.
Boulin Instrument Corp.
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Hathaway Inst. Co.
Hayes Scientific App.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Steel City Testing
Suter, Alfred
Testing Machines, Inc.
Toledo Scale Co.

TESTERS & TESTING MACHINES, Torsional Creep
Baldwin-Southwark Corp.
Suter, Alfred

TESTERS & TESTING MACHINES, Turn Indicator
Amthor Testing Inst. Co.
Pioneer Instrument
Rieker Instrument Co.
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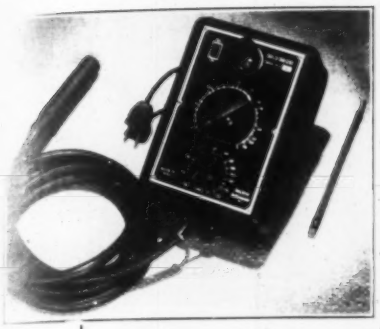
TESTERS & TESTING MACHINES, Weathering
Atlas Elec. Devices Co.
Gen. Elec. Lamp. Dept.

TESTERS & TESTING MACHINES, Wire
Amthor Testing Inst. Co.
Baldwin-Southwark Corp.
Krouse Fatigue Mach.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Steel City Testing
Suter, Alfred
Taber Instrument Co.

TESTERS & TESTING MACHINES, Yarn
Atlas Elec. Devices Co.
Brown Inst. Co.
Emerson Apparatus Co.
Saxl Inst. Co.
Scott Co., Henry L.
Suter, Alfred
Testing Machines, Inc.

For addresses, see pages 66-76



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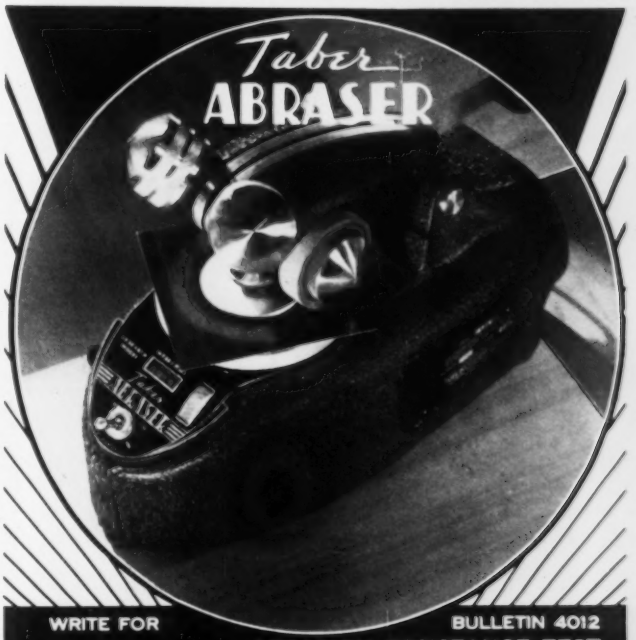

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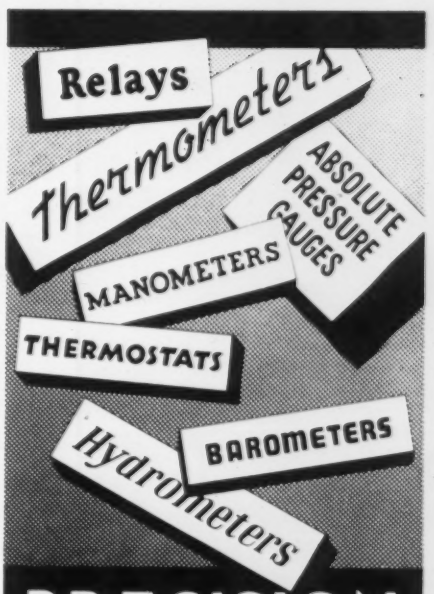

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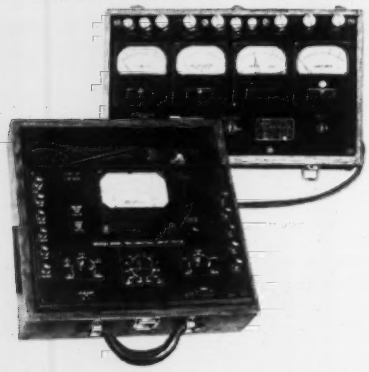

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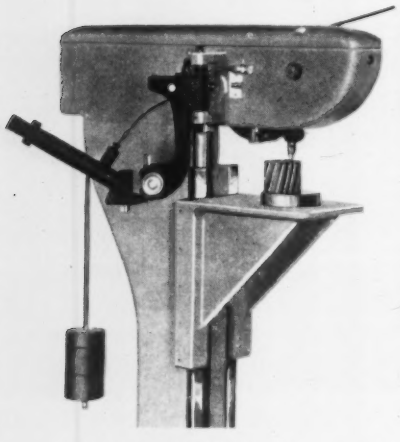

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Dietert Co.
Olsen Testing Machine
Saxl Inst. Co.

TESTING MACHINES, UNIVERSAL, Dead Weight Beam, Capacities 100-5000 lb.
Olsen Testing Machine
Riehle Div.

TESTING MACHINES, UNIVERSAL, Dead weight beam, Capacities 5000-100,000 lb.
Riehle Div.

(TESTING Mach. Cont'd on page 48)

TESTING MACHINES, UNIVERSAL, Dead weight beam, Capacities over 100,000 lb.
Baldwin-Southwark Corp.
Olsen Testing Machine
Riehle Div.

TESTING MACHINES, Universal, Hydraulic, Capacities 0-100 lb.
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Saxl Instrument Co., Inc.
Steel City Testing Lab.
Thwing-Albert Instrument

TESTING MACHINES, Universal, Hydraulic, Capacities 100-5000 lb.
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Baldwin-Southwark Corp.
Detroit Testing Machine
Dietert Co., Harry W.
Emery Co.
Ferner Co.
Pittsburgh Instrument
Riehle Div.
Saxl Instrument Co.
Steel City Testing Lab.

TESTING MACHINES, Universal, Hydraulic, Capacities 5000-100,000 lb.
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Detroit Testing Machine
Riehle Div.
Steel City Testing Lab.

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Riehle Div.

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Amthor Testing Inst. Co.
Dietert Co.
Olsen Testing Machine
Riehle Div.
Saxl Inst. Co.
Scott Co., Henry L.
Steel City Testing
Suter, Alfred

TESTING MACHINES, UNIVERSAL, Pendulum, Capacities 100-5000 lb.
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Dietert Co.
Olsen Testing Machine
Riehle Div.
Scott Co., Henry L.
Steel City Testing
Suter, Alfred
Testing Machines, Inc.

TESTING MACHINES, UNIVERSAL, Pendulum, Capacities 5000-100,000 lb.
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Olsen Testing Machine
Riehle Div.
Steel City Testing
Suter, Alfred

TESTING MACHINES, UNIVERSAL, Pendulum, Capacities over 100,000 lb.
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Olsen Testing Machine
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Suter, Alfred

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Chatillon & Sons
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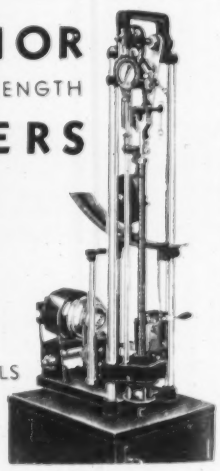

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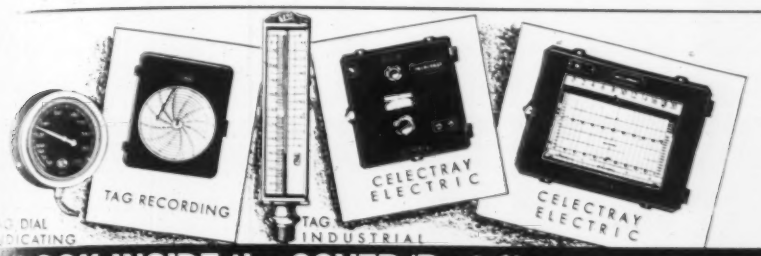

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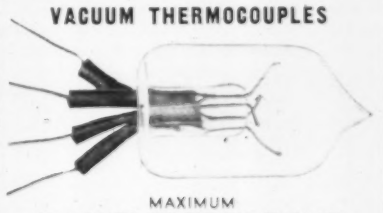

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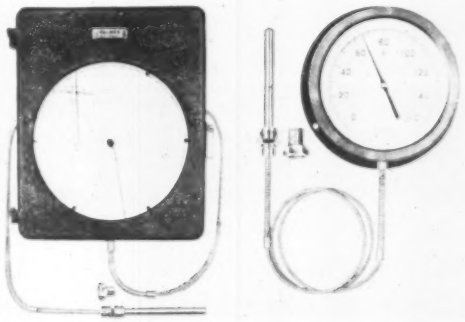

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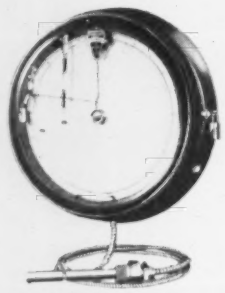

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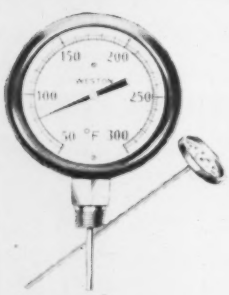

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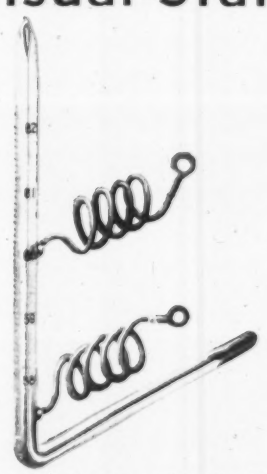

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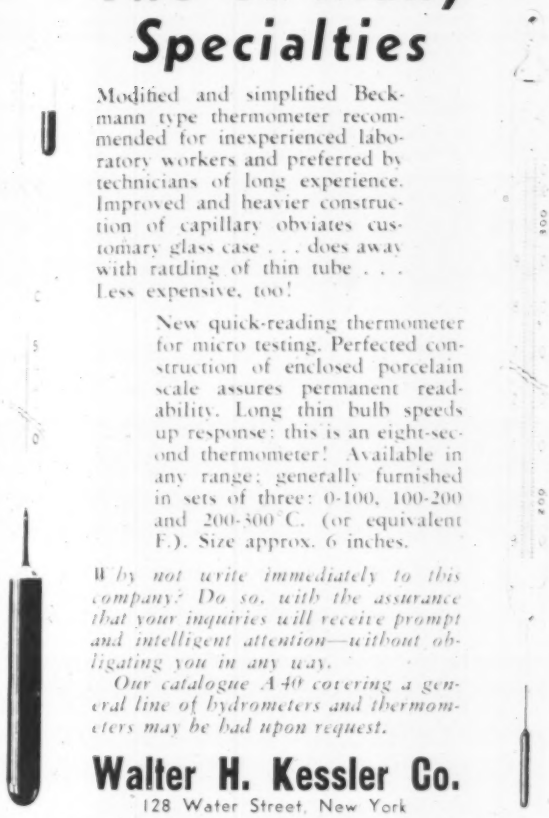

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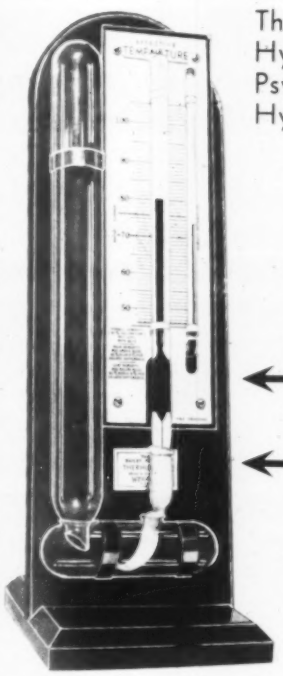

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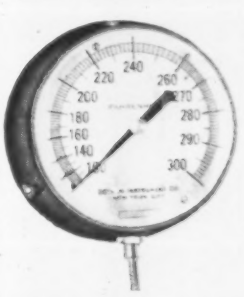

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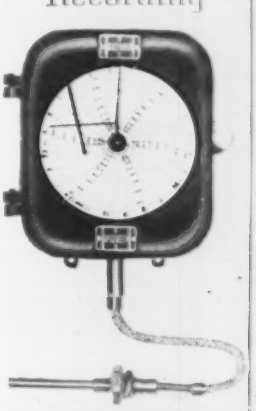

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Esterline-Angus Co.
Friez & Sons
Fuess, Inc.
Gaertner Scientific Corp.
Gotham Inst. Co.
Industrial Instrument Co.
Jaeger Watch Co.
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Scientific Inst. Co.
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TIME, Recorders (Cont'd)
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Simplex Time Recorder
Stromberg Electric Co.
Tagliabue Mfg. Co.
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Cramer & Co., Inc.
Edison Electrical Controls
General Electric X-Ray
Guardian Elec. Mfg. Co.
Luxtrol Co., Inc.
Marston Co.
Paragon Electric Co.
Perfex Corp.
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Thompson Clock Co.
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Walser Automatic Timer
Warren Telechron Co.
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Automatic Time Stamp
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Calculagraph Co.
Cincinnati Time Rec.
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Gaertner Scientific Corp.
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Jaeger Watch Co.
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Automatic Stamp Co.
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Dietzgen Co., Eugene
Electric Tachometer Corp.
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National Instrument Co.
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Tagliabue Mfg. Co.
Taylor Inst. Cos.
Warren Telechron Co.
Zenith Electric Co.
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Automatic Temp. Control
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Bristol Co.
Brown Inst. Co.
Consol. Ashcroft Hancock
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Eagle Signal Corp.
Elec. Switch Corp.
Foxboro Co.
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Warren Telechron Co.
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Am. Timer Corp.
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Automatic Elec. Mfg.
Automatic Temp. Control
Bacon, Emra D.
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Luers, J. Milton
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Perfex Corp.
Production Inst. Co.
Standard Elec. Time
Stromberg Electric Co.
Struthers-Dunn
Tagliabue Mfg. Co.
Thomas Clock Co.
Thompson Clock Co.
Walser Automatic Timer
Warren Telechron Co.
Zenith Electric Co.
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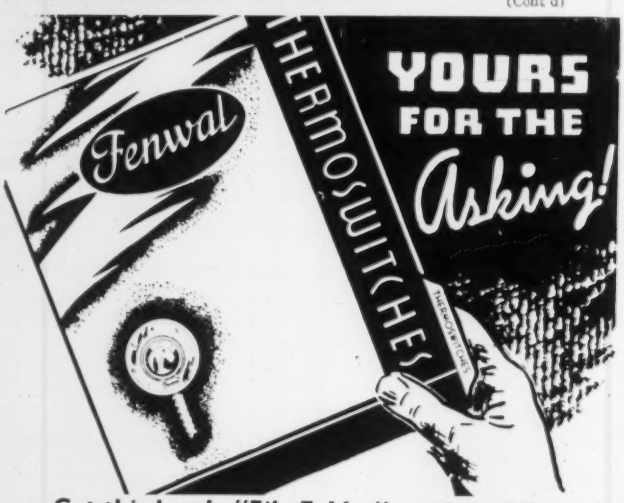

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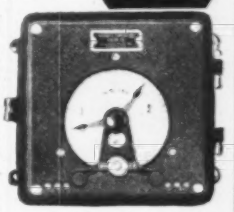

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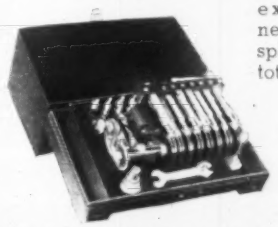

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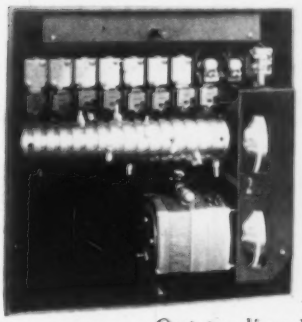

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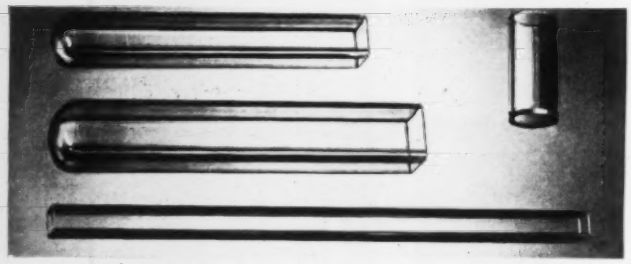

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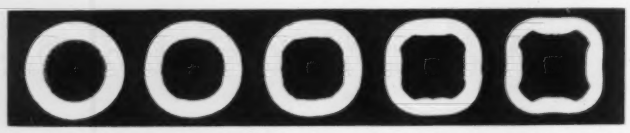

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Klipfel Mfg. Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Powers Regulator Co.
Refrigerating Spec. Co.
Reynolds Gas Regulator
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Tagliabue Mfg. Co.
Vaughn-G. E. Witt Co.
Wilgus Manufacturing

VALVES, Diaphragm
Askania Regulator Co.
(Cont'd)

VALVES, Diaphragm (Cont'd)
Atlas Valve Co.
Bailey Meter Co.
Bastian-Blessing Co.
Belfield Co.
Boylston Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Davis Reg. Co.
Defender Automatic Reg.
D'Este Co.
Fisher Governor
Foster Engg. Co.
Foxboro Co.
General Controls Co.
Hanlon-Waters, Inc.
Illinois Eng. Co.
Industrial Instrument
Johnson Service Co.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
McCorkle Co.
Minneapolis-Honeywell
National Airoil Burner
Natural Gas Equipment
(Cont'd)

VALVES, Diaphragm (Cont'd)
Partlow Corp.
Payne Furnace & Su...
Powers Regulator C...
Refrigerating Spec...
Republic Flow Meters
Reynolds Gas Regu...
Ruggles-Klingemann
Schade Valve Mfg.
Scientific Instrument
Spence Engineering
Spencer Thermostat
Tagliabue Mfg. Co.
Taylor Inst. Cos.
Vaughn-G. E. Witt
White-Rodgers Elec...
Wilgus Manufacturing

VALVES, Electrically Operated
Atkins & Co.
Atlas Valve Co.
Automatic Products Co.
Automatic Switch Co.
Automatic Temp. Control
Bristol Co.
Brown Inst. Co.
Cochrane Corp.
Cutler-Hammer, Inc.
Davis Reg. Co.
Defender Automatic Reg.
Detroit Lubricator Co.
Electric Valve Mfg.
Electrimatic Corp.
Foster Engg. Co.
Foxboro Co.
Frick Co.
Friez & Sons
General Controls Co.
Hannifin Mfg. Co.
Hunt & Son
Illinois Eng. Co.
Jenkins Bros.
Kiely & Mueller
Klipfel Mfg. Co.
Leslie Co.
Magnatrol Valve Corp.
Mason-Neilan Regulator
McAlear Mfg. Co.
McCorkle Co.
McDonnell & Miller
Minneapolis-Honeywell
Northern Equipment Co.
Payne Furnace & Supply
Penn Electric Switch
Perfex Corp.
Refrigerating Spec. Co.
Ruggles-Klingemann
Schade Valve Mfg. Co.
Shallcross Mfg. Co.
Spence Engineering Co.
Supreme Elec. Prods.
Tagliabue Mfg. Co.
White-Rodgers Elec. Co.

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Askania Regulator
Atlas Valve Co.
Auto. Temp. Control
Bailey Meter
Barber-Coleman Co.
Cash Co.
Controls, Inc.
Defender Automatic Reg.
Fisher Governor
Foster Engg. Co.
Gen. Electric Co.
Hays Corp.
Jenkins Bros.
Kiely & Mueller
Leslie Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Powers Regulator Co.
Republic Flow Meter
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Sterling Eng. Co.

VALVES, Lubricated Plug
Merco Nordstrom Valve

VALVES, Motor Operated (See Valves, Diaphragm; Valves, Electrically-operated; Valves, Hydraulically - operated; Valves, Solenoid)

Taylor
"MOTO-STEEL"
EVENACTION DIAPHRAGM VALVES

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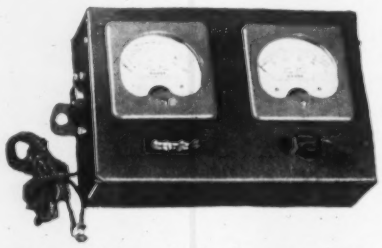

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Shown at left is meter box of our model No. 6 gauge.

This gauge successfully used by many of America's foremost manufacturers.

Send for circular on our new low priced D.C. operated gauge.

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Connelly Iron Sponge
Consol. Ashcroft Hancock
Crosby Steam Gage Co.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
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Foster Engg. Co.
Foxboro Co.
Fulton Sylphon Co.
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Hanlon-Waters, Inc.
Hoke, Inc.
Illinois Eng. Co.
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Kenyon Instrument Co.
Kiely & Mueller
Klipfel Mfg. Co.
Lammert & Mann Co.
Leslie Co.
Marsh Corp., Jas. P.
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McAlear Mfg. Co.
Minneapolis-Honeywell
Natural Gas Equipment
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Republic Flow Meters
Ruggles-Klingemann
Schade Valve Mfg. Co.
Spence Engineering Co.
Spencer Thermostat Co.
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Tagliabue Mfg. Co.
Taylor Instr. Cos.
Vapor Recovery Systems
Vaughn G. E. Witt Co.
Victor Equipment Co.
Watts Regulator Co.
Wilgus Manufacturing

VALVES, Proportional Air-Gas
American Meter Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Connelly Iron Sponge
Fisher Governor Co.
Hanlon-Waters, Inc.
Lammert & Mann Co.
Mason-Neilan Regulator
McAlear Mfg. Co.
Tagliabue Mfg. Co.

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American Meter Co.
Arco Regulators, Inc.
Atlas Valve Co.
Automatic Valve Control
Bailey Meter Co.
Bastian-Blessing Co.
Bellfield Co.
Boylston Co.
Boilerr Room Equipment
Bristol Co.
Brown Inst. Co.
Cash Co.
Cochrane Corp.
Connelly Iron Sponge
Consol. Ashcroft Hancock
Davis Reg. Co.
Defender Automatic Reg.
D'Este Co.
Dyckson Co.
Electromatic Corp.
Fisher Governor Co.
Ford Reg. Valve Co.
Foster Engg. Co.
Foxboro Co.
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Fulton Sylphon Co.
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Hanlon-Waters, Inc.
Hannifin Mfg. Co.
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Jenkins Bros.
Kiely & Mueller
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Constant Voltage

FOR YOUR LABORATORY, YOUR PRODUCT, OR YOUR PRODUCTION LINE

UTC **STEADI-VOLT**

- ACCURACY 1%
- INDEPENDENT OF LOAD
- NO MOVING PARTS
- HIGH POWER FACTOR
- HIGH EFFICIENCY
- NEGLIGIBLE TIME CONSTANT
- LOW DISTORTION
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AUTOMATIC VOLTAGE REGULATORS

95-130 VOLT INPUTS . . . 110, 115, 120 VOLTS OUTPUT ± 1%

The UTC automatic voltage regulator is NEW. It involves no moving parts and effects instantaneous correction for either transient or chronic line voltage fluctuations.

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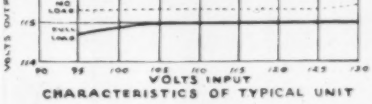
AR-5	250	46.00
AR-6	500	67.00
AR-7	1000	110.00
AR-8	2000	200.00



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Designs for 220 volt service available at 25% increase in price. for 50 cycle units increase price 25%; for 42 cycles, 35% increase; for 25 cycles, increase price 100%. Special secondary voltages available to customers' specifications at small increase in price.

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The unique design of these regulators makes possible the construction of special units with relative ease. The output can be arranged to provide filament and plate voltage, or any other special voltages that may be required. Write for details.

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The most complete equipment ever offered for studying Diesel and gasoline engine pressures, torsional, linear, and planar vibrations.

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Spence Engineering Co.
Tagliabue Mfg. Co.
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Victor Equipment Co.
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Askania Regulator Co.
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Automatic Products Co.
Automatic Switch Co.
Bristol Co.
Brown Inst. Co.
Cash Co.
Davis Reg. Co.
D'Este Co.
Detroit Lubricator Co.
Eclipse Fuel Engg. Co.
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Friez & Sons
Fulton Sylphon Co.
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General Controls Co.
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Partlow Corp.
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Penn Electric Switch
Preferred Utilities Mfg.
Ruggles-Klingemann
Spence Engineering Co.
Spencer Thermostat Co.
Tagliabue Mfg. Co.
Viking Instrument Co.
Wilgus Manufacturing

VALVES, Solenoid
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Automatic Switch Co.
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Brown Inst. Co.
Cutler-Hammer, Inc.
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Deroit Lubricator Co.
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American Inst. Co.
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Potter Co.
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Televiso Co.

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Commercial Engg. Labs.
Ruska & Co.

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Fish-Schurman Corp.
Fisher Scientific Co.
Precision Scientific Co.
Ruska & Co., Inc.
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Tagliabue Mfg. Co., C. J.
Thomas Co., Arthur H.

VISCOSIMETERS, Brookfield
Brookfield Eng. Labs.

VISCOSIMETERS, Engler
American Inst. Co.
Boekel & Co.
Central Scientific Co.
Humboldt Mfg. Co.
Precision Scientific Co.
Ruehfel Co.

VISCOSIMETERS, Fenske
American Inst. Co.

VISCOSIMETERS Ford (For Paint)
Central Scientific Co.
Eimer & Amend
Scientific Inst. Co.

VISCOSIMETERS, Hoepler
Central Scientific Co.
Fish-Schurman Co.
Sargent & Co.

VISCOSIMETERS, Kinematic
Eimer & Amend

VISCOSIMETERS, MacMichael
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Brabender Corp.
Esterline-Angus Co.

VISCOSIMETERS, Redwood
American Inst. Co.
Ruehfel Co.

VISCOSIMETERS, Saybolt
American Inst. Co.
Boekel & Co.
Central Scientific Co.
Corning Glass Works
Humboldt Mfg. Co.
Kimble Glass Co.
Precision Scientific Co.
Ruehfel Co.
Tagliabue Mfg. Co.
Visco-Meter Corp.
Zuhr, Inc., Henry

VISCOSIMETERS, Scott
Boekel & Co.
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Precision Scientific Co.
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VISCOSIMETERS, Stormer
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VISCOSITY REGULATORS (See Controllers, Automatic, Viscosity)

VISCOSITY TUBES
Cargille, R. P.

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General Elec. Co.
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Roller-Smith Co.
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United Transformer Corp.

VOLTAGE DETECTORS (See Detectors, Voltage)

VOLTAGE DIVIDERS, Radio Frequency (See Dividers, Voltage)

VOLTAGE, HIGH (above 2300 volts) Indicators
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General Physical Lab.
Ideal Commutator Dresser
Rawson Electrical Inst.
Roller-Smith Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Triplett Electrical Inst.
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VALVES

Foxboro valves for air-operated controllers should be specified with Foxboro Controllers because the characteristic of the Valve should fit the characteristic of the instrument. The Valve is a vital part of a Control installation. The Foxboro line is engineered to assure the best results.

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WINSLOW PORTABLE INSTRUMENTS

Complete line—AC — DC — Thermal
High degree of accuracy
Rugged construction
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Dependable performance
Moderately priced

Write for bulletin P-10-1

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RECORDING VISCOSITY WITH AUTOMATIC CONSTANT-SPEED TEMPERATURE INCREASE

THE VISCOGRAPH

Recording Viscosimeter, with the following novel features:

1—Automatic constant speed temperature increase—from room temperature to 150° C

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The VISCOGRAPH has been applied successfully in the testing of:

Oil	Glue	Artificial Silk
Printing Ink	Dextrin	Starch
Latex		Flour, etc.

Brabender Corporation Rochelle Park, New Jersey

For addresses, see pages 66-76

VIBRATION *can be isolated*

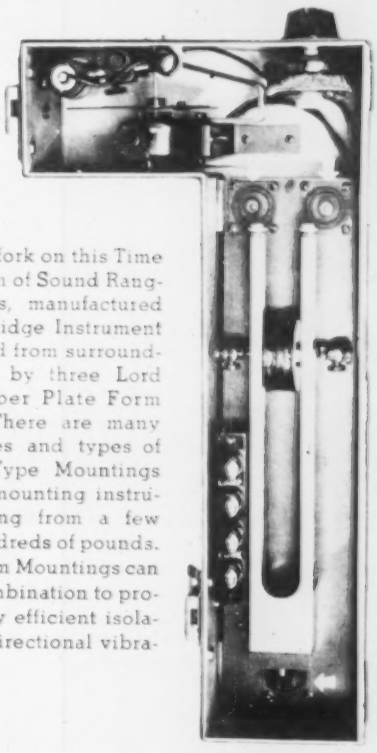
USE LORD BONDED RUBBER SHEAR TYPE MOUNTINGS TO MAINTAIN THE ACCURACY OF YOUR INSTRUMENTS UNDER VIBRATION AND SHOCK

When properly designed into an instrument, Lord Shear Type Mountings will localize and isolate any vibration that would otherwise affect the operating accuracy of the instrument.

The effectiveness of these mountings is based on the fact that rubber when stressed in shear deflects more readily than when under direct tension or compression. In applying this principle Lord has perfected many varieties of bonded rubber mountings that provide unusual radial stability and axial elasticity.

Panels, sub-panels and individual instruments can be protected from vibration and shock regardless of their size or weight, or the frequencies of the disturbing vibrations.

Our engineering department has solved hundreds of vibration problems for designers and manufacturers of instruments. This extensive knowledge of vibration engineering is available to you.



The tuning fork on this Time Marker System of Sound Ranging Apparatus, manufactured by the Cambridge Instrument Co., is isolated from surrounding vibration by three Lord Bonded Rubber Plate Form Mountings. There are many different styles and types of Lord Shear Type Mountings available for mounting instruments weighing from a few ounces to hundreds of pounds. Lord Plate Form Mountings can be used in combination to provide extremely efficient isolation of multi-directional vibratory forces.

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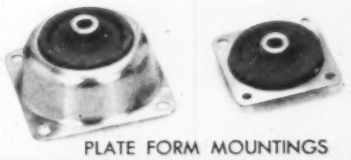


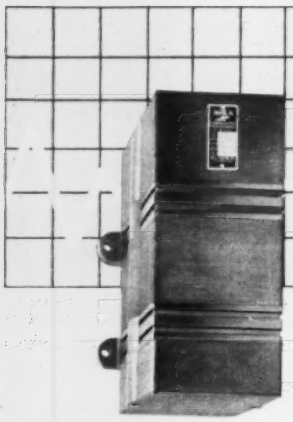
PLATE FORM MOUNTINGS

LORD
BONDED RUBBER
SHEAR TYPE
VIBRATION
MOUNTINGS

TUBE FORM MOUNTINGS

FRACTIONAL H. P. FLEXIBLE COUPLINGS

IT TAKES RUBBER IN SHEAR TO ISOLATE VIBRATION



CONSTANT VOLTAGE

FOR YOUR LABORATORY . . . FOR YOUR PRODUCTION LINE . . . OR INCORPORATED IN YOUR PRODUCTS

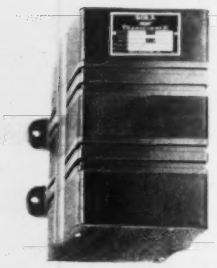
Whether it's 1 VA for an instrument or 10 KVA for a production line—if your needs call for stable voltage at all times, SOLA CONSTANT VOLTAGE TRANSFORMERS will deliver for you.

Fully automatic, instantaneous in operation, SOLA CONSTANT VOLTAGE TRANSFORMERS have no moving parts and require no maintenance. They are self-protecting and cannot be damaged by short circuit. AND—they will maintain their output voltage to within a fraction of a percent of the specified value, even though the line voltage varies *as much as thirty percent.*

You can build a SOLA CONSTANT VOLTAGE TRANSFORMER into your product and stop worrying about your customer's line voltage. There will be no burn-outs from over-voltage, no operating failures due to under-voltage and no erratic performance resulting from line transients.

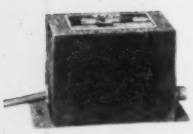
You can build a SOLA CONSTANT VOLTAGE TRANSFORMER into your production line or your laboratory and know that every test will be made under the same line conditions, that those conditions will not change from the start of your test to its finish, and, above all, that if a short circuit occurs, there will be no fires, no ruined transformer, no blown fuses.

You'll find these SOLA CONSTANT VOLTAGE TRANSFORMERS surprisingly compact—and economical, too. To augment or replace non-regulating types, standard designs are available, or units can be built to your special specification. So—whether it's 1 VA for an instrument or 10 KVA for a production line—make it a SOLA and be sure! Our engineers will assist you in selecting the type best suited to your needs. *Write for Bulletin GCV-22.*



For capacities above 200 VA. Housing type.

From 20—200 VA. Primary cord set, and output receptacle.



A new unit for applications up to 15 VA. Equipped with leads or terminals.

SOLA

SOLA ELECTRIC CO. 2525 Clybourn Chicago, Illinois

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Associated Research
General Elec. Co.
Ideal Commutator Dresser
International Resistance
Miller Co., Bertrand F.
Raytheon Mfg. Co.
Roller-Smith Co.
States Co.
Superior Elec. Co.
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De Jur-Amsco Corp.
Esterline-Angus Co.
General Elec. Co.
Hickok Elec. Inst. Co.
RCA Manufacturing Co.
Rawson Electrical Inst.
Reliance Instrument Co.
(Cont'd)

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Sensitive Research Inst.
Supreme Instruments
Therm-Electric Meters Co.
Triplett Electrical Inst.
Welch Mfg. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst. Corp.

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General Electric Co.

VOLTMETERS, Contact Making
Burton-Rogers Co.
Electronic Laboratory
Electric Tachometer Corp.
Engineering Labs., Inc.
Esterline-Angus Co.
Ferranti Electric, Inc.
General Electric Co.
Geophysical Instrument Co.
Hickok Electrical Inst.
Reliance Instrument Co.
Roller-Smith Co.
Ruska & Co., Inc.
Weston Electrical Inst.

VOLTMETERS, Electrostatic
Cambridge Inst. Co.
Ferranti Electric, Inc.
General Elec. Co.
Hathaway Inst. Co.
Rawson Electrical Inst.

VOLTMETERS, Indicating
Ballantine Labs.
Burton-Rogers Co.
Clough-Brengle Co.
Columbia Elec. Mfg.
De Jur-Amsco Corp.
Ferranti Electric, Inc.
General-Elec. Co.
Hickok Elec. Inst. Co.
Niagara Electrical Inst.
Norton Electrical Inst.
Precision Apparatus Corp.
Radio City Products Co.
Rawson Electrical Inst.
RCA Manufacturing Co.
Roller-Smith Co.
Sensitive Research Inst.
Simpson Elec. Co.
Triumph Mfg. Co.
Welch Mfg. Co.
Westinghouse Elec. & Mfg.
Weston Elec. Inst Corp.
Winslow Co.

VOLTMETERS, Megohm
Associated Research
Jackson Electrical Inst.
Rawson Electrical Inst.
RCA Manufacturing Co.
Sensitive Research Inst.
Shallcross Mfg. Co.
Sticht & Co.
Televiso Co.
Welch Mfg. Co.
Weston Elec. Inst. Corp.

VOLTMETERS, Micro
Cambridge Inst. Co.
De Jur-Amsco Corp.
Hickok Elec. Inst. Co.
Microvolts, Inc.
Rawson Electrical Inst.
Sensitive Research Inst.
Supreme Instruments
Televiso Co.
Triplett Electrical Inst.
Weston Elec. Inst. Corp.
Wheelco Inst. Co.

VOLTMETERS, Micro, Radio Frequency
Ferris Inst. Corp.

VOLTMETERS, Millivoltmeters
Ballantine Labs.
Bristol Co.
Burton-Rogers Co.
Cambridge Inst. Co.
De Jur-Amsco Corp.
Engelhard, Chas.
Esterline-Angus Co.
Etna Elec. Works
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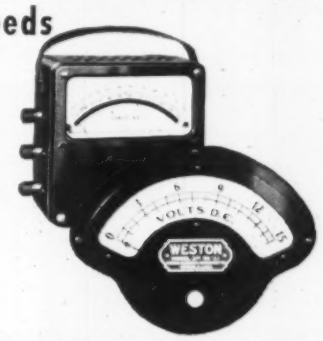

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Buffalo Scale Co., 1200 Niagara St., Buffalo, N. Y.
Scales

Builders Iron Foundry, 9 Codding St., Providence, R. I.
High pressure flow, level, weight, pressure & temperature, metering & control instruments

Bullard Co., E. D., 275 Eighth St., San Francisco, Calif.
Gas leak detectors

Bunnell & Company, J. H., 215 Fulton St., New York, N. Y.
Relays & switches

Burgess Battery Co., Freeport, Ill.
Dry batteries

Burke, Louis, 41 John St., New York, N. Y.
Stop watches and chronometers

Burling Instrument Co., 251-253 Springfield Ave., Newark, N. J.
Temperature controls for laboratories, Industrial processes, furnaces & ovens. (-100° to 1400°F.) Standard tubes of special alloys & ranges.

Burlington Instrument Corp., Burlington, Iowa
Electrical control apparatus

Burrell Technical Supply Co., 1942 Fifth Ave., Pittsburgh, Pa.
Scientific instruments & laboratory supplies

Burt Scientific Labs., R. C., 1212 E. Green St., Pasadena, Calif.
Special instruments

Burton-Rogers Co., 857 Boylston St., Boston, Mass.
Electrical instruments

Bushnell and Nevius, 913 N. LaCienega Blvd., Los Angeles, Calif.
Control apparatus

C

Calculagraph Co., Harrison, N. J.
Elapsed time indicator

Calibron Products, Inc., 51 Lakeside Ave., West Orange, N. J.
Special apparatus

Calkins Co., 934 S. Main St., Los Angeles, Calif.

Callahan & Co., E. J., 14 W. Barre St., Baltimore, Md.

Calta Glass Wks., 2158 Ogden Ave., Chicago, Ill.

Cambosco Scientific Co., Waverley, Mass.

Cambridge Instrument Co., Inc., Grand Central Terminal, New York, N. Y.
Scientific & industrial instruments

Cameron Surgical Specialty Co., 666 W. Division St., Chicago, Ill.

Campbell Electric Co., Lynn, Mass.
Transformers, high frequency & X-ray equipment

Campion Labs., Don C., 9088 Alpine Ave., Detroit, Mich.
Liquid meters for small flows

Cardwell Mfg. Corp., Allen D., 81 Prospect St., Brooklyn, N. Y.
Variable & fixed air condensers

Cargille, R. P., 118 Liberty St., New York, N. Y.
Chemical laboratory & photographic devices

Cash Company, A. W., Decatur, Ill.
Combustion control instruments.

Central Scientific Co., 1700 Irving Park Blvd., Chicago, Ill.
Scientific instruments & laboratory apparatus

Central Station Steam Co., 2910 E. Woodbridge St., Detroit, Mich.
Rotary type condensate meter

Certified Gauge & Inst. Co., 34-18 Northern Blvd., Long Island City, N. Y.
Pressure gages

Chace Co., W. M., 1600 Beard Ave., Detroit, Mich.
Thermostatic bimetals

Chaslyn Co., 4527 Ravenswood Ave., Chicago, Ill.
Storage battery testers

Chatillon & Sons, John, 85 Cliff St., New York, N. Y.
Iso-elastic springs

Chelsea Clock Company, 284 Everett Ave., Chelsea, Mass.
Clocks & clock movements

Chemical Rubber Co., 1933 West 114th St., Cleveland, Ohio
Laboratory supplies

Chicago Apparatus Co., 1735 No. Ashland Ave., Chicago, Ill.
Laboratory supplies

Chicago Dial Indicator Co., 511 W. Washington, Chicago, Ill.
Machinist's dial indicators

Chicago Surgical & Electrical Co., 321 W. Superior St., Chicago, Ill.

Cincinnati Clock & Instrument Co., 1113 York St., Cincinnati, Ohio
Circuit breaker analyzer

Cincinnati Scientific Co., 224 Main St., Cincinnati, Ohio
Laboratory supplies

Cincinnati Time Recorder Co., 1733 Central Ave., Cincinnati, Ohio
Time recorders

Claflin Co., Geo. L., 150 Borrance St., Providence, R. I.

Clapp Inst. Co., Webster, Mass.
Aircraft instruments, thermometers & pressure & vacuum gages

Clare & Co., C. P., Lawrence & Lamon Ave., Chicago, Ill.
Relays, electric counters & electro mechanical specialties

Clark Blast Meter Co., Chas. J., Gladbrook, Iowa
Foundry blast meters & pressure gages

Clark & Sons Co., Alvan, 58 Day St., West Somerville, Mass.
Optical & astronomical instruments

Clarostat Mfg. Co., Inc., 285 North Sixth St., Brooklyn, N. Y.
Resistors

Clay-Adams Co., Inc., 25 E. 26th St., New York, N. Y.
Angle & micro centrifuges, compact balances, analytical weights, microscope slides & cover glasses, glass & porcelain ink, tuning forks

Clebar Watch Co., 551 Fifth Ave., New York, N. Y.
Stop watches, timers & chronographs

Cleveland Gas Meter Co., 2180 East 65th St., Cleveland, Ohio
Tin case gas meters

Clifford Mfg. Co., 584 E. First St., Boston, Mass.
Metallic bellows & diaphragms; thermostatic assemblies; packless valves

Clough-Brengle Co., 5501 Broadway, Chicago, Ill.
Electrical instruments, communication testing instruments

Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y.
Spring testers

Cochrane Corp., 17th St., Allegheny Avenue, Philadelphia, Pa.
Flowmeters, electrical & mechanical; liquid level meters & controllers; weir meters; pressure & temperature recorders; blow off & relief valves

Cole Co., H., 24 North High St., Columbus, Ohio
Surveying instruments

Coleman Electric Co., Inc., 310 Madison St., Maywood, Ill.
Electrical measuring instruments for technical applications

Colloid Equipment Co., Inc., 50 Church St., New York, N. Y.
Laboratory apparatus

Columbia Electric Mfg. Co., 4519 Hamilton Ave., Cleveland, Ohio
Rheostats, instruments, shunts, switchboards & special electrical equipment

Commerce Pattern Foundry & Machine Co., 2211 Grand River Ave., Detroit, Mich.
Balancing machines

Commercial Engineering Labs., 4612 Woodward Ave., Detroit, Mich.
Laboratory instruments for automotive, aircraft, railway & allied industries; air flow indicators, direct pressure & piezo-ray engine indicators, fuel flow indicators, magnetic gages, torsional vibration indicators (piezo-ray), recorders (torsiographs) & recording instruments for car performance & riding comfort

Commercial Iron Works, 2426 Porter St., Los Angeles, Calif.
Orifice fittings

Comtor Company, 87 Rumford Ave., Waltham, Mass.
Precision internal & external comparator-type diameter gages

Conant, George H., 719 Watson St., Ripon, Wis.

Connelly Iron Sponge & Governor Co., 3154 So. California Ave., Chicago, Ill.
Gages & manometers, B T U indicator & H_2S tester

Consolidated Ashcroft Hancock Co., American Schaeffer & Budenberg Div., Bridgeport, Conn.
Industrial instruments

Consulting & Engineering Co., Carson St. & Terminal Way, Pittsburgh, Pa.
Combustion controllers

Continental Electric Co., Geneva, Ill.
Photoelectric tubes & equipment

Controls, Inc., Towaco, N. J.
Control valves; motor driven time delay relays; process timing devices

Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Electrical control devices, metal bellows, vapor motors & telephone protective & distributing apparatus

Coors Porcelain Co., Golden, Colo.
Chemical & scientific porcelain

Corbin Screw Corp., New Britain, Conn.
Tachometers & speedometers

Cornell-Dubilier Electric Corp., So. Plainfield, New Jersey
Mica, dykanol, paper & wet & dry electrolytic capacitors

Corning Glass Works, Corning, N. Y.
Technical glassware

Coxhead Corp., Ralph C., 17 Park Place, New York, N. Y.
Composing typewriter with changeable faces and spaces used for preparing catalogues, bulletins, folders, forms, etc. for stencil or offset production.

Cramer Co., Inc., R. W., Centerbrook, Conn.
Interval timers, running time meters, time switches, signal control switches

Crosby Steam Gage & Valve Co., 30 Church St., New York, N. Y.
Safety & relief valves, gages, recorders, testers & steam engine indicators

Crowley & Co., Henry L., 1 Central Ave., West Orange, N. J.
Capacitors

Curtin & Co., W. H., 2019 Franklin Ave., Houston, Tex.
Laboratory supplies

Cutler-Hammer, Inc., 315 North 12th St., Milwaukee, Wis.
Electric motor control, safety switches, motor driven valve operators, gas calorimeters, gas mixing & stabilizing control, resistors

D

Daigger & Co., A., 159 W. Kinzie St., Chicago, Ill.
Laboratory supplies

Daniel Orifice Fitting Co., 3350 U. P. Ave., Los Angeles, Calif.
Orifice fittings

Daven Co., 158 Summit St., Newark, N. J.
Attenuators, calibrating equipment for electrical instruments & resistors

Davis Emergency Equipment Co., Inc., 57 Van Dam Street, New York, N. Y.
Inflammable gas alarms

Davis Regulator Co., 2541 So. Washtenaw Ave., Pilsen Sta., Chicago, Ill.
Valves

Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
Chromium plated gage blocks

Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
Industrial instruments

De Jur-Amsco Corp., Shelton, Conn.
Photoelectric exposure meters, electrical, radio & photographic products

Delmhorst, Wm. J., 90 West St., New York, N. Y.
Moisture detectors

Deming Indicator Co., 108 Fountain Ave., Dayton, Ohio
Test indicators

Demuth Glass Works, Inc., Wythe Ave. at N. 11th St., Brooklyn, N. Y.

Denominator Co., Inc., 261 Broadway, New York
Group counting machines

Denver Fire Clay Co., 2301 Blake St., Denver, Colo.
Specialized industrial control equipment for power plant & processing industries, laboratory specialties

D'Este Co., Julien, 6 Spice St., Charlestown, Mass.
Control valves

Detroit Air Meter Co., P. O. Box 1473, Detroit, Mich.
Air flowmeters

Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Automatic controls & equipment for air conditioning

Detroit Testing Machine Co., Grinnell Ave., Detroit, Mich.
Testing machines

Deutschmann Corp., Tobe, Canton, Mass.
Equipment for locating, eliminating, and measuring radio noise; electrolytic, paper dielectric & oil type capacitors

Dickson Co., 7420 Woodlawn Ave., Chicago, Ill.
Furnace controls

Dietert Co., Harry W., 9330 Roselawn Ave., Detroit, Mich.
Sand testing equipment; immersion pyrometers, moisture testers, accessories for spectrographic laboratories

Dietzen Co., Eugene, 2425 Sheffield Ave., Chicago
Drafting & surveying instruments

Dillon & Co., Inc., W. C., 5410 W. Harrison St., Chicago, Ill.
Traction dynamometers, tensile machines, thermometers

Distillation Products, Inc., 755 Ridge Road West, Rochester, N. Y.
High vacuum pumps, low vapor pressure fluids & auxiliary equipment

Dockson Co., C. H., 3839 Wabash Ave., Detroit, Mich.
Regulating valves

Doerr Glass Co., Inc., 500 Peach St., Vineland, N. J.

Dongan Electric Mfg. Co., 2987 Franklin St., Detroit, Mich.
Transformers

Dorr-Patterson Engineering Co., 2362 Wight St., Detroit, Mich.
Physical testing machines

Drafto Co., Cochranton, Pa.
Drafting machines

Driftmeter, Inc., 616 Exchange Bank Bldg., Tulsa, Okla.
Oil well instruments

Dubrovin, John, 2946 N. Kennetir Ave., Chicago, Ill.
Mercurial vacuum gage, absolute type

Ducommun Co., M., 580 Fifth Ave., New York, N. Y.
Coil-spring stopwatches

Du Mont Labs., Inc., Allen B., 2 Main Ave., Passaic, N. J.
Cathode-ray oscillographs, cathode-ray tubes, associated electronic equipment, television control, studio & transmitting equipment

Duncan Electric Mfg. Co., Lafayette, Ind.
A-c. & d-c. watthour meters, service & switchboard types; portable test meters, appliance meters & instrument transformers

Dunn, Inc., Struthers, 1310 Cherry St., Philadelphia, Pa.
Relays, timing devices, electric counters, thermostats

Durant Manufacturing Co., 1030 N. Buffum St., Milwaukee, Wisc.
Counting & measuring machines

Dwyer Mfg. Co., F. W., 565 W. Washington Blvd., Chicago, Ill.
Portable & stationary draft gages, CO_2 indicators & combustion testing sets

E

Eagle Signal Corp., 202 20th St., Moline, Ill.
Industrial control devices, traffic signal controllers & sign flashers

Eastern Engineering Co., 45 Fox St., New Haven, Conn.
Laboratory pumps, stirrers & thermoregulators

Eastern Science Supply Co., 7-9 High St., Brookline, Mass.
Meteorological instruments

Eastern Scientific Co., 51 Bassett St., Providence, R. I.

Eastern Specialty Co., 3617 N. 5th St., Philadelphia, Pa.
Testing equipment for checking & maintenance of all types of electricity meters such as watthour meters, demand instruments, etc. Special apparatus for load survey work.

Eberbach & Sons, Ann Arbor, Mich.
Laboratory furniture

Eby, Inc., Hugh H., 4700 Stenton Ave., Philadelphia, Pa.
Relays & radio parts

Eclipse Aviation, Div. of Bendix Aviation Corp., Bendix, N. J.
Aircraft electrical & mechanical accessories

Economy Electric Devices Co., 37 West Van Buren St., Chicago, Ill.
Electric meters, watthour & amperehour, for street and electric railways and trolley busses

Edelmann & Co., E., 2332 Logan Blvd., Chicago, Ill.
Automotive test instruments

Edison, Inc., Thomas A., Edison Electrical Co... division, West Orange, N. J.
Sealed-in-glass control devices, including th... static switches, fire detection thermostats, & ... relays. Hermetically sealed thermostatic valves. ...cial control equipment

Eimer & Amend, 205-223 Third Ave., New York, N. Y.
Biological & chemical laboratory apparatus & ... plies

Eitzen Co., Louis C., 204 W. 59th St., New ... N. Y.
Extensometers

Electric Controller & Mfg. Co., 2700 East 7... Cleveland, Ohio
Electrical controllers

Electric Heat Control Apparatus Co., 175 Fifth ... New York, N. Y.
Laboratory ovens

Electric Indicator Corp., 21 Parker Ave., Stamford, Conn.
Synchronous motors, position indicators, level controls, signalling devices

Electric Sorting Machine Co., Michigan Trust Bldg., Grand Rapids, Mich.
Color analysers

Electric Speed Indicator Co., 14618 Hayes Ave., Lakewood, Ohio
Precision electric tachometers & remote position indicators

Electric Switch Corp., 1409 Union St., Columbus, Ind.
Mercury switches

Electric Tachometer Corp., 1358 Spring Garden St., Philadelphia, Pa.
Speed indicators & recorders, electric & mechanical counters

Electric Valve Mfg. Co., 64 Murray, New York, N. Y.
Electrically operated valves

Electrical Coil Winding Co., 2736 Saunders St., Camden, N. J.
Magnet & solenoid coils

Electrical Facilities Inc., 4224 Holden St., Oakland, Calif.
Apparatus for electrical measuring & testing, including precision transformers, watthour meter and instrument transformer testing equipment; rectifier apparatus

Electrical Research Products Inc., 195 Broadway, New York, N. Y.
Instruments are offered for acoustic, noise or vibration control problems, in the product development laboratory, for field testing and for routine production testing applications

Electrical Testing Labs., 80th St. & East End Ave., New York, N. Y.
Electrical testing & inspection

Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Automatic control valves & controls, regulating valves, Pressure, temperature & electrical actuated

Electro-Medical Laboratory, Inc., Hollston, Mass.
Neurological & allied medical instruments & general electronic apparatus

Electro Products Laboratories, 549 West Randolph St., Chicago, Ill.
Battery eliminators & rectified A.C. devices

Electrocon Corp., 6 Varick St., New York, N. Y.
Vibration measuring instruments & equipment for dynamic balancing of rotating machines

Electronic Laboratory, 306 S. Edinburgh Ave., Los Angeles, Calif.
Photo-electric instruments; also photoconductive cells

Electronic Products Co., St. Charles, Ill.
Electronic devices

Electronic Research Laboratory, Niles Center, Illinois
Color analysis apparatus

Electrons, Inc. of Delaware, 127 Sussex Ave., Newark, N. J.
Gas-filled & grid-control rectifier tubes

Elematic Mfg. Co., 7542 S. Chicago Ave., Chicago, Ill.
Pyrometers

Elgin National Watch Co., Elgin, Ill.
Watches, clocks, aircraft instruments

Ellison Draft Gage Co., 214 West Kenzie St., Chicago, Ill.
Manometers, draft gages, orsats

Elsbett Mfg. Co., Inc., 910 W. Lake St., Chicago, Ill.
Remote control fractional horsepower motors

Emerson Apparatus Co., 171 Tremont St., Melrose, Mass.
Calorimeters

Emery Co., A. H., 682 Main St., Stamford, Conn.
Bourdon gages

Empire Laboratory Supply Co., 549 W. 52nd St., New York, N. Y.
Laboratory supplies

E-Nam Corporation, 45 E. 17 St., New York, N. Y.
Fine enameled copper wire

Engel, Inc., H. C. M., P. O. Box 233, Sidney, N. Y.
Small drills, small turned parts, millstones in sapphire and block grinding discs

Engelhard, Inc., Charles, 233 New Jersey R. R. Ave., Newark, N. J.
Industrial instruments

Engineering Laboratories, Inc., 705 Kennedy Bldg., Tulsa, Okla.
Seismic exploration equipment, vibration detector, petroleum engineering devices, signalling equipment

Eppley Laboratory Inc., 12 Sheffield Ave., Newport, R. I.
Thermopiles, pyrheliometers & standard cells for both industrial & laboratory use

Co., 1825-39 Wylie St., Philadelphia, Pa.
motor overload protectors.
Co., O. E., 1274 Augusta Blvd., Chicago, Ill.
Instrument Co., 31 Irving Place, New York, N. Y.
indicators & recorders, visual & electric
shore indicators, flame failure alarms, sensi-
relays & special electric eye indicators.
Angus Co., Inc., P. O. Box 596, Indian-
Ind.
recording & contact-making electrical in-
ments, time, speed, condensate purity, pressure
vacuum recorders, telemeters & portable current
transformers.
Mfg. Co., 214 W. Huron St., Chicago, Ill.
feeders.
Weight Scale Co., 944 West 5th Ave., Colum-
Ohio.
over-and-under weight scales & indicators for in-
dustrial purposes.

F

Fairchild Instrument Corp., Watertown, N. Y.
Laboratory thermometers.
Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill.
Scales.
Falstrom Co., Main Ave. & D. L. & W. R. R., Passaic, N. J.
Steel instrument panels, panel board assemblies, cubicles, totally enclosed weather & vermin proof instrument enclosures & steel cabinets.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lgrge micrometers.
Fassett Co., Inc., C. M., 209 North Wall St., Spokane, Wash.
Laboratory supplies.
Fecker, J. W., 2016 Perrysville Ave., N. S., Pittsburgh, Pa.
Astronomical instruments.
Federal Pneumatic Systems, Inc., 127 N. Dearborn St., Chicago, Ill.
Particle size classifiers.
Federal Products Corp., 1144 Eddy St., Providence, R. I.
Precision measuring instruments.
Fee and Stemkedel, Inc., 4449 North Pulaski Rd., Chicago, Ill.
Dial type thermometers, barometers, humidity indicators & allied products, field glasses & binoculars.
Fenwal, Inc., 3 Main St., Ashland, Mass.
Industrial thermostats.
Ferner Co., R. Y., 131 State St., Boston, Mass.
Precision instruments.
Ferranti Electric, Inc., 30 Rockefeller Plaza, New York, N. Y.
Electrical instruments.
Ferris Instrument Corp., Boonton, N. J.
Laboratory & production testing equipment, radio noise & field strength meters & special electrical instruments.
Fidelity Machine Co., 3906 Frankford Ave., Philadelphia, Pa.
Abrasion testers.
Field Electrical Instrument Co., 2258 Morris Ave., New York, N. Y.
Vacuum thermocouples.
Fink-Roselieve Co., Inc., 109 W. 64th St., New York, N. Y.
Thermometers.
Fischer & Porter Co., 59 W. Queen Lane, Germantown, Philadelphia, Pa.
Rotameters, sight flow meters, precision glass tubes of any shape including square, oval, cylindrical, tapered.
Fish-Schurman Corp., 250 East 43rd St., New York, N. Y.
Scientific instruments, optical, technical & scientific glassware & porcelain.
Fisher Governor Co., Marshalltown, Iowa
Motor control valves & regulators.
Fisher Scientific Co., 711 Forbes St., Pittsburgh, Pa.
Standard & special equipment & instruments for chemical, biological & metallurgical laboratories.
Fleischhauer & Son, Frank, 89-26 187 Place, Hollis, L. I., N. Y.
Thermometers & hydrometers.
Fluid Meters, Inc., 44 Wall St., Room 1101, New York, N. Y.
Positive displacement meters, 1/10 to 8 gallons per hour with gravity pressures.
Ford Meter Box Co., Wabash, Indiana
Water meter testers.
Ford Motor Company, 3674 Schaefer Rd., Dearborn, Mich.
Johansson gage blocks & accessories such as parallels, adjustable holders, scribers, straight edges, center points, sine bars.
Ford Regulator Valve Co., 103 Broome St., New York, N. Y.
Regulating valves.
Foster Engineering Co., 169 Monroe St., Newark, N. J.
Control valves.
Foxboro Co., 46 Neponset Ave., Foxboro, Mass.
Indicating, recording & controlling instruments for pressure, temperature, humidity, level & flow.
Fredericks Co., George E., Bethayres, Pa.
Glass instruments & apparatus.
Frick Co., Inc., Waynesboro, Pa.
Floor case controls & electric controls, refrigerating & air conditioning machinery.
Fried & Lustig, Inc., 31 Union Square, New York, N. Y.
Thermometers.
Fries & Sons, Division, Julien P., Bendix Aviation Corp., Baltimore St. & Central Ave., Baltimore, Md.
Temperature & humidity controls, gas & stoker controls, damper motors, electrical relays, temperature & humidity indicators & recorders, psychrometers, draft gages, anemometers, CO_2 analyzers.
Frobel-Taylor Co., P. O. Box 242, Chagrin Falls, Ohio
Photoelectric colorimeters.
Fuess, Inc., R., 29 West 60th St., New York, N. Y.
Scientific instruments.
Fulton Sylphon Co., Knoxville, Tenn.
Temperature & pressure regulators, sylphon bellows; thermostat assemblies; diesel controls; automobile thermostats; air conditioning controls.
Furnas Electric Co., 811 South 72nd St., West Allis, Wis.
Pressure controls.

G

Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago, Ill.
Physical & scientific instruments.
Gas Appliance Specialties Co., 57th St., bet. Northern Blvd. & 32nd Ave., Woodside, New York, N. Y.
Gas regulators.
Gauthier, Donat A., 7408 Poe Ave., Detroit, Mich.
Gasoline measuring devices & automobile service station testers.
Geier & Bluhm Inc., 607 River St., Troy, N. Y.
Mechanical devices & spirit level vials.
Genales, Andrew, 29 Second Ave., Nyack, N. Y.
Toolroom test indicators.
General Biological Supply House, Inc., 761 East 69th Pl., Chicago, Ill.
Biological laboratory supplies.
General Combustion Corp., 2218 W. Lake St., Chicago, Ill.
Combustion equipment.
General Controls Co., 1370 Harrison, San Francisco, Calif.
Control valves.
General Electric Co., 1 River Rd., Schenectady, N. Y.
Electrical instruments & meters.
General Electric Co., Lamp Dept., Nela Park, Cleveland, Ohio
Lighting sources.
General Electric X-Ray Corp., 2012 Jackson Blvd., Chicago, Ill.
Medical, dental & industrial X-ray apparatus, accessories & suppliers.
General Engg. & Model Works, 421 N. Braddock Ave., Pittsburgh, Pa.
Gages & precision measuring instruments for checking threaded tubular products.
General Physical Laboratory, 500 Fifth Ave., New York, N. Y.
Electronic apparatus.
General Radio Co., 30 State St., Cambridge, Mass.
Radio & electrical measuring instruments for laboratory & industrial use; stroboscopes, noise measuring equipment, measuring & test equipment for electrical communication systems.
General Regulator Corp., 165 Broadway, New York, N. Y.
Combustion, draft, liquid level & pressure controls.
General Sales & Products Corp., 47 Mohawk St., Cohoes, N. Y.
Shut-off valves.
General Scientific Corp., 4829 So. Kedzie Ave., Chicago, Ill.
Lenses & photoelectric cells.
General Television Corp., 70 Brookline Ave., Boston, Mass.
Ionization vacuum gages.
Geophysical Instrument Co., 1315 Half St., S. E., Washington, D. C.
Instruments & accessories for prospecting for oil, minerals, water, bedrock; also equipment for making measurements in wells.
Gilmore, E. R., Box 5718, Homewood Sta., Pittsburgh, Pa.
Gas leak stethoscopes.
Gilmore Drug Co., W. J., 422 Blvd. of Allies, Pittsburgh, Pa.
Laboratory supplies.
Gisholt Machine Co., Madison, Wis.
Static & dynamic balancing machines.
Glass Engraving Co., 3604-3606 Park Ave., New York, N. Y.
Glass engraving.
Gleason-Avery, Inc., 27 Clark, Auburn, N. Y.
Furnace controls.
Globe Phone Mfg. Corp., Reading, Mass.
Pipe locating equipment, leaky valve locators, hearing aids, secret phone or listening equipment for government investigating agencies.
Globe Tool & Engg. Co., 410 Davis Ave., Dayton, Ohio
Dynamic balancing equipment.
Glogau & Co., 1612 Rand McNally Bldg., Chicago, Ill.
Calipers.
G-M Laboratories, Inc., 1731 Belmont Ave., Chicago, Ill.
Photoelectric cells, photoelectric relays, slide wire rheostats, galvanometers, laboratory stands & clamps.
G. M. Manufacturing Co., 180 Centre St., New York, N. Y.
Thermometers, hydrometers, psychrometers, hygrometers.
Goetz American Optical Co., C. P., 317 East 34th St., New York, N. Y.
Photographic lenses & accessories.
Goetze Nieger Co., 808 Francis St., St. Joseph, Mo.
Golden Co., 1031 S. Broadway, Los Angeles, Calif.
Surveying instruments.
Goodrich Co., B. F., 450 South Main St., Akron, Ohio
Vibration absorbers.
Gordon Co., Claud S., 1524 S. Western Ave., Chicago, Ill.
High temperature equipment accessories, such as thermocouples, thermocouple wire, lead wire, insulators.
Gorrell & Gorrell, Chicago Heights, Ill.
Equipment for biological & psychological work.
Gotham Instrument Co., 127 Spring St., New York, N. Y.
Indicating, dial & recording thermometers.
Gotham Scientific Co., 106 Water St., New York, N. Y.
Laboratory supplies.
Gow-Mac Instrument Co., 22 Lawrence St., Newark, N. J.
Thermal conductivity gas analyzers & gas analysis cells.
Gray Instrument Co., 614½ W. Johnson St., Philadelphia, Pa.
Scientific instruments.
Green, Arthur R., 284 Harris Ave., Needham, Mass.
Paper plant test instruments.
Green, Henry J., 1101 Bedford Ave., Brooklyn, N. Y.
Meteorological instruments.
Greene Bros., Inc., 1810 Griffin St., Dallas, Texas
Laboratory supplies.
Greenfield Tap & Die Corp., Greenfield, Mass.
Machine shop gages.
Greiner, Inc., Emil, 55 Vandam St., New York, N. Y.
Laboratory supplies.
Griebel Instrument Co., Inc., 42 River St., Carnondale, Pa.
Thermometers, hydrometers, chemical & laboratory glassware.
Grimes Co., A. J., 117 East 13th St., Kansas City, Mo.
Laboratory supplies.
Grove Regulator Co., 1729 Poplar St., Oakland, Calif.
Pump governors, pressure reducing & back pressure regulators for gas or liquid pressures to 4000 lbs.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
A.c. and d.c. relays.
Gumm Co., R. F., 135 S. Clinton St., Chicago, Ill.
Scales.
Gurley, W. & L. E., 514 Fulton St., Troy, N. Y.
Surveying & allied engineering instruments, paper testing & astronomical navigation instruments & standard weights & measures.

H

Hagan Corp., 600 Bowman Bldg., Pittsburgh, Pa.
Combustion control equipment.
Haines Gauge Co., 119 South 10th St., Philadelphia, Pa.
Dial micrometer gage.
Hall-Ibson Co., 1500 Ravenswood Ave., Chicago, Ill.
Laboratory transformers.
Halliburton Oil Well Cementing Co., Duncan, Okla.
Oil well surveying instruments.
Hamilton Mfg. Co., Two Rivers, Wis.
Laboratory furniture.
Hanlon-Waters, Inc., Box 1750, Tulsa, Okla.
Pressure & level controls, time cycle controllers.
Hamplin Mfg. Co., 621 So. Kolmar Ave., Chicago, Ill.
Valve operating devices.
Hanovia Chemical & Mfg. Co., 90 Chestnut St., Newark, N. J.
Quartz mercury arc lamps.
Hardwick, Hindle, Inc., 40 Hermon St., Newark, N. J.
Resistors.
Hart Manufacturing Co., 110 Bartholomew Ave., Hartford, Conn.
Thermostats, remote control switches, magnetic relays, heater switches, motor control switches, mercury tube relays.
Hart Mfg. Co., R. E., 116 Ward Bldg., Battle Creek, Mich.
Production counters.
Hart Moisture Gauges, Inc., 126 Liberty St., New York, N. Y.
Kaydel moisture gages.
Hasler-Tel Co., 30 Vesey St., New York, N. Y.
Speed indicators, portable chronometric.
Hathaway Instrument Co., 517 S. University Blvd., Denver, Colo.
Instruments & apparatus for electrical & physical measurements & control.
Hausser & Son, C. A., 6040 Belfield Ave., Philadelphia, Pa.
Hays Scientific Appliances, 202 N. Broadway, Urbana, Ill.
Scientific instruments.
Hays Corp., P. O. Box 259, Michigan City, Ind.
Combustion instruments & automatic valve controls.

Hayward, H. N., 612 W. Oregon St., Urbana, Ill.
Tachometer Testers

H-B Electric Co., Inc., 2501 N. Broad St., Philadelphia, Pa.
Mercury tube relays

H-B Instrument Co., Inc., 2501 N. Broad St., Philadelphia, Pa.
Thermometers & hydrometers, remote control equipment

HD Electric Co., 100 W. Monroe St., Chicago, Ill.
Split core ammeters

Hebler Co., W. O., Central at Long Ave., Hillside, N. J.
Electrical gas analyzers

Heil Chemical & Mfg. Co., 216 S. 4 St., St. Louis, Mo.
Laboratory Supplies

Heiland Research Corp., 700 Club Bldg., Denver, Colo.
Geophysical & industrial instruments

Heise Bourdon Tube Co., 275 Noble Ave., Bridgeport, Conn.
Bourdon tube devices

Hellige, Inc., 3718 Northern Blvd., Long Island City, N. Y.
Scientific instruments, laboratory & bacteriological supplies

Henderson & Co., H. B., East Liverpool, Ohio
Pyrometric cones

Henschel & Co., Inc., John, 105 E. 29th St., New York, N. Y.
Drawing instruments

Henszey Co., Watertown, Wis.
Feed water meters, flow indicators *continuous blow-down*, heat exchangers and boiler feed regulators. Also meters and flow indicators for corrosive chemicals

Heusser Instrument Mfg. Co., 134 West Second South St., Salt Lake City, Utah
Analytical balances

Hewlett-Packard Co., 367 Addison Ave., Palo Alto, California
Electronic equipment

Heyman Co., 157 Chambers St., New York, N. Y.
Inspection Instruments

H & H Thermostats, Inc., 270 Lafayette St., New York, N. Y.

Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio
Electric indicating instruments

Hoffman Co., S. O., 835 Howard St., San Francisco, Calif.
Rolometers

Hoke, Inc., 585 Eagle Ave., New York, N. Y.
Regulators

Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Fractional Horsepower Motors

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich.
Thermo-couples, heating elements, pyrometers & electric furnaces

Houser Engg. & Mfg. Inc., 123 N. Main St., Bluffton, Ind.
Miles per Gallon Meter

Howard Clock Products, Inc., 256 Charles St., Waltham, Mass.
Observatory & seismological clocks.

Howe & French, Inc., 99 Broad St., Boston, Mass.
Laboratory supplies

Howe Scale Co., Rutland, Vt.
Scales

Humboldt Mfg. Co., 2014 N. Whipple St., Chicago, Ill.
Cement & concrete testers

Hunt & Son, C. B., Salem, Ohio
Valves & valve operating devices.

Hydraulic Press Co., Mount Gilead, Ohio
Pressure controls

Hy Et Electrical Products Mfg. Co., 1515 West Pico, Los Angeles, Calif.
Automobile service station instruments

I

Ideal Commutator Dresser Co., 1420 Park Ave., Sycamore, Ill.
Insulation testers & revolution counters

Illinois Engineering Co., Racine Ave. & 20th Pl., Chicago, Ill.
Regulating valves

Illinois Testing Laboratories, Inc., 420 North La Salle St., Chicago, Ill.
Indicating pyrometers, resistance thermometers, pyrometer controllers, air velocity meters, metal detectors.

Impact Register Co., 315 So. Neil St., Champaign, Ill.
Instruments for determining and recording impacts received by railroad cars and riding qualities of railroad cars, automobiles

Improved Gauge Mfg. Co., 101-105 Canal St., Syracuse, N. Y.
Bourdon gages

Indicating Calipers Corp., 506 East 19th St., New York, N. Y.
Indicating calipers

Industrial Engineering Corp., Evansville, Ind.
Relays

Industrial Instrument Co., 2219 11th St., S. W., Akron, Ohio
Temperature, pressure & time cycle controllers, indicating & dial thermometers, diaphragm valves.

Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J.
Electrical measuring & test equipment

Industrial-Scientific Supply Co., 828½ Monroe St., Fort Worth, Texas
Laboratory Supplies

Industrial Timer Corp., 101 Edison Place, Newark, N. J.
Industrial Timers

Industrial X-Ray Co., 1613 Second Ave., Seattle, Wash.
X-Ray Equipment

Industro-Scientific Co., 340 So. Camac St., Philadelphia, Pa.
Valentine refractometers & PQ viscosimeters

Inferno Co., Box 1138, Shreveport, La.
Combustion instruments

Instrument Resistors, Inc., 375 Main St., Little Falls, N. J.
Wire wound resistors

Instrument Specialties Co., Inc., 379 Main St., Little Falls, N. J.
Precision micrometer

International Business Machines Corp., 590 Madison Ave., New York, N. Y.
Scales & time instruments

International Equipment Co., 352 Western Ave., Boston, Mass.
Analytical centrifuges

International Filter Co., 325 W. 25th Place, Chicago, Ill.
Hydraulic measurement & control & chemical feeding & proportioning.

International Register Co., 25 South Throop St., Chicago, Ill.
Coin meters—timers for electric ranges & gas ovens.

International Resistance Co., 401 N. Broad St., Philadelphia, Pa.
Metallized & wirewound fixed & variable resistors including high voltage & high frequency types.

J

Jackson Electrical Instrument Co., 129 Wayne Ave., Dayton, Ohio
Radio testing equipment

Jacobs Bros. Co. Inc., 1 Main St., Brooklyn, N. Y.
Scales

Jaeger Watch Co., Inc., 304 East 45th St., New York, N. Y.
Automobile clocks, timepieces for aviation and marine, chronometric tachometers & true airspeed indicators

Jardur Import Co., 21 W. 19th St., New York, N. Y.
Chronographs & stop-watches

Jarrell-Ash Co., 165 Newburg St., Boston, Mass.
Representatives for Adam Hilger, Ltd., manufacturers of optical instruments

J B L Instrument Ct., P. O. Box 135, Darby, Pa.
Rotary instrument switches, transformer tapping, railway signal gear, decade resistance boxes.

J-B-T Instruments, Inc., 441 Chapel St., New Haven, Conn.
Electrical measuring & controlling instruments: pyrometers, thermocouples, selector switches, potentiometers, resistance thermometers, laboratory instruments

Jeffrey Mfg. Co., Columbus, Ohio
Weighting, feeding, batching & proportioning equipment

Jenkins Bros., 80 White St., New York, N. Y.
Regulating valves

Jensen Instrument Co., 335 Central Ave., Los Angeles, Calif.
High pressure manometer

Johnson Service Co., 507 E. Michigan St., Milwaukee, Wisc.
Automatic temperature & humidity control for heating, cooling, ventilating, air conditioning & industrial processes

Johnson-Williams, Ltd., Box S, Palo Alto, Calif.
Combustible gas indicators & alarm systems, portable & continuous, including accessories

Johnston & Jennings Co., 877 Addison Rd., Cleveland, Ohio
Oil meters

Johnston Manufacturing Co., 2823 E. Hennepin Ave., Minneapolis, Minn.
Furnace controls

Jones & Lamson Machine Co., Clinton & Whitmore Sts., Springfield, Vt.
Optical comparators

Jones Motrola Sales Co., 432 Fairfield Ave., Stamford, Conn.
Tachometers

Jones-Orme Co., 1645 Hennepin Ave., St. Paul, Minn.
Audio frequency standard signal generators, oscillators, laboratory amplifiers & special audio frequency laboratory equipment

Jorgan Co., 65 Atlantic Ave., Rochester, N. Y.

Judson Governor Co., 38 Browns Race, Rochester, N. Y.
Governors

K

Kansas City Laboratory Supply Co., 1434 Wyandotte St., Kansas City, Mo.
Laboratory supplies

Karp Metal Products Co. Inc., 129-30th St., Brooklyn, N. Y.
Instrument panels

Kaufman-Lattimer Co., 263 N. Front St., Columbus, Ohio
Laboratory Supplies

Keller Mfg. Co., G. P., 2802 Colorado Ave., Santa Monica, Calif.
Balances & weights of precision

Kelley-Koett Mfg. Co. Inc., Covington, Ky.
X-Ray apparatus

Kellogg Switchboard & Supply Co., Clearing Station, Chicago, Ill.
Relays

Kenyon Instrument Co., Inc., 273 New York Ave., Huntington, L. I., N. Y.
Airport & marine instruments

Kern Co., 136 Liberty St., New York, N. Y.
Surveying & astronomical instruments

Kessler Co., Walter H., 213 Pearl St., New York, N. Y.
Thermometers and hydrometers

Keuffel & Esser Co., Adams & Third Sts., Hoboken, N. J.
Surveying instruments

Kewaunee Mfg. Co., 106 Lincoln St., Kewaunee, Wis.
Laboratory furniture

Kieley & Mueller, Inc., 40 W. 13th St., New York, N. Y.
Pressure regulating & flow control devices

Kimball Co., W. W., 420 Kimball Bldg., Chicago, Ill.
Laboratory furniture

Kimble Glass Co., Vineland, N. J.
Glass apparatus, glass tubing, thermometers, hydrometers

King-Seeley Corp., 302 Second St., Ann Arbor, Mich.
Fuel level, oil pressure & temperature gages; also ammeters & voltmeters

Klett Mfg. Co., 179 E. 87th St., New York, N. Y.
Colorimeters

Klinzorit, Inc., 16 Hudson St., New York, N. Y.
Liquid level gages

Klipfel Mfg. Co., 2641 W. Harrison St., Chicago, Ill.
Regulating valves

Knopf, Paul, 13 Ave. & 37 St., Long Island City, N. Y.
Registering instruments for vehicles

Knowles Scale Works, Lowell, Mass.
Platform, counter & beam scales

Koch & Co., F. A., 72 Spring St., New York, N. Y.

Kolesch & Co., 128 Fulton St., New York, N. Y.
Surveying instruments

Kollmorgen Optical Co., 767 Wythe Ave., Brooklyn, N. Y.
Astronomical & optical instruments

Kollsman Instrument Div., Square D Co., 8008 - 45th Ave., Elmhurst, Long Island, N. Y.
Precision instruments for aircraft

Kron Co., Bridgeport, Conn.
Scales

Krouse Testing Machine Co., 101 E. Dominion Blvd., Columbus, Ohio
Fatigue testing machines

Kuner Co., Max, 804 First Ave., Seattle, Wash.
Nautical instruments

Kurman Electric Co., Inc., 241 Lafayette St., New York, N. Y.
Relays, electrical test equipment, hearing devices

L

L. A. B. Corp., P. O. Box 162, Summit, N. J.
Special instruments

Laboratory Construction Co., 1113-15 Holmes St., Kansas City, Mo.
Laboratory furniture & apparatus

Laboratory Furniture Co., Inc., 37-18 Northern Blvd., Long Island City, N. Y.
Laboratory furniture

Laboratory Materials Co., 7319 Vincennes Ave., Chicago, Ill.
Laboratory supplies

Laboratory Specialties, Inc., 130 S. Wabash St., Wabash, Ind.

Lambert Meter Co., Inc., Plainfield, N. J.
Gas meters

Lammert & Mann Co., 260 N. Woods St., Chicago, Ill.
Flow regulators & valves

LaMotte Chemical Products Co., McCormick Bldg., Baltimore, Md.
Hydrogen ion apparatus

Lampkin Laboratories, Bradenton, Fla.
Radio-frequency meters

Landis & Gyr, Inc., 104 Fifth Ave., New York, N. Y.
Electric integrating meters; indicating & graphic demand meters for KW, KVA, reactive; prepayment meters; totalizing & remote; time switches; motor wound escapement or synchronous motor types with astronomic dials; miniature ball bearings

Lantz-Phelps Corp., 420 Linden Ave., Dayton, Ohio
Automotive test instruments

...ne & Co., Arthur S., 114 W. Hubbard St., Chicago, Ill.
...oratory supplies
... Relay Co., 5915 Avalon Blvd., Los Angeles, Calif.
...lays
...ds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.
Electrical measuring instruments for both laboratory & plant. For laboratory: bridges, galvanometers, potentiometers, photometric equipment, test sets & standards. For plant: indicators, recorders & controllers for chemical concentration, CO_2, current, electrolytic conductivity, frequency, gas analysis, humidity, Kw, Rkva, light, electrical load, pH, pressure, pyrometry, radiation, smoke density, speed, temperature, voltage. Speedomax Recorders, Centrimax Flowmeters & Metermax Combustion control systems
Leitz, Inc., E., 730 Fifth Ave., New York, N. Y.
Optical instruments
Lenox Instrument Co., 2010 Chancellor St., Philadelphia, Pa.
Optical and technical instruments
Leslie Co., Lyndhurst, N. J.
Pressure reducing valves, pump governors, temperature regulators
Leupold, Volpel & Co., 425 N. E. 70th Ave., Portland, Oregon
Recorders & indicators, for irrigation, power, waterworks, sewerage. Equipment for hydraulic laboratories. Snow-rain recorders, hydrographic accessories, transits, levels
Lewis Engineering Co., 52 Rubber Ave., Naugatuck, Conn.
Portable pyrometers, potentiometers, resistance thermometers & other electrical temperature measuring devices
Kaydel moisture gages
Lewyt Metal Products, 112 Lafayette St., New York, N. Y.
Instrument housings
Lincoln Meter Co., Springfield, Ill.
Thermal ampere demand & watt demand meters, indicating & graphic
Lindberg Engineering Co., 221 North Laflin St., Chicago, Ill.
Electric power input controls
Link Engineering & Mfg. Co., 1054 W. Baltimore Ave., Detroit, Mich.
Spring testers
Lipman Engineering Co., 415 Van Braam St., Pittsburgh, Pa.
Photoelectric counters
Liquidometer Corp., 36-16 Skillman Ave., Long Island City, N. Y.
Liquid level gages
Littelfuse, Inc., 4757 Ravenswood Ave., Chicago, Ill.
Low range precision fuses & fuse mountings
Lord Mfg. Co., 1316 Holland Ave., Erie, Pa.
Vibration proof mountings & flexible couplings for practical horsepower motors
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Timers
Lufkin Rule Co., Saginaw, Mich.
Precision tools & measuring tapes
Lumenite Electric Co., 37 West Van Buren St., Chicago, Ill.
Photoelectric controls
Lundquist Tool & Mfg. Co., 57 Jackson St., Worcester, Mass.
Ammeters
Lux Clock Mfg. Co., Inc., 95 Johnson St., Waterbury, Conn.
Automatic timers & clock mechanisms
Luxtrol Co., Inc., 54 West 21st St., New York, N. Y.
Photoelectric apparatus

M

Macbeth Daylighting Corp., 227 West 17th St., New York, N. Y.
Daylight Lamps for titration & color matching
Machlett & Son, E., 220 East 23rd St., New York, N. Y.
Laboratory apparatus & supplies
Magnaflux Corp., 605 W. Washington St., Chicago, Ill.
Magnetic inspectors
Magnatrol Valve Corp., 52 Beekman St., New York, N. Y.
Valves
Magnavox Co., Inc., Fort Wayne, Indiana
Electrolytic capacitors
Magnetic Analysis Corp., 42-44 12th St., Long Island City, N. Y.
Magnetic inspectors for uniform cross-sectional steel
Magnetic Gauge Co., 60 E. Bartges St., Akron, Ohio
Continuous gages, sheet & strip
Mahady Co., E. P., 857 Boylston St., Boston, Mass.
Mahoney, James A., 140 West 42nd St., New York, N. Y.
Products of glass
Marine Compass Co., Bryantville, Mass.
Marine instruments
Maris Co., John M., 528 Arch St., Philadelphia, Pa.
Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Indicating gages, recording gages, dial thermometers, recording thermometers, refrigeration service instruments, temperature controlling systems, valves for heating systems
Marston Co., C. A., 506 Washington St., Braintree, Mass.
Time study instruments
Martindale Electric Co., Box 2669, Lakewood Branch, Cleveland, Ohio
Insulation testers
Martin-Decker Corp., P. O. Box 571, Long Beach, Calif.
Torque gages & pull rod dynamometers
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Industrial control equipment for pressure temperature, flow, liquid level, combustion & ratio: diaphragm control valves; pressure & vacuum regulators; level controllers; pump speed governors; pump pressure regulators; pipe strainers
McAlear Mfg. Co., 1901 S. Western Ave., Chicago, Ill.
Manual & automatic controls for air, oil gas, steam, chemicals, pure food, acid & alkali
McCord Radiator & Mfg. Co., 2585 E. Grand Ave., Detroit, Mich.
Liquid meters for low flows
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Calif.
Thermostats & electric gas valves
McDonnell & Miller, Room 1316, Wrigley Bldg., Chicago, Ill.
Boiler controls
McDonnell Odometer Co., 3501 So. Kedzie Ave., Chicago, Ill.
Counters
McFarlin Co., 29 West Marion Ave., Youngstown, Ohio
Leak detectors
McKesson-Boster-Northington Co., 1706 First Ave., Birmingham, Ala.
Laboratory supplies
McNab of Bridgeport, Inc., Bridgeport, Conn.
Marine appliances, torsionmeters, salinity indicators, revolution counters
McNeill Engineering Equipment Co., T. W., 4057 West Van Buren St., Chicago, Ill.
Smoke alarms
Measurements Corp., Boonton, N. J.
Radio Frequency Testing & Measuring Devices
Mellophone Corp., 714 University Ave., Rochester, N. Y.
Rectifiers
Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.
Automatic controls for heating, refrigeration, air conditioning, & various industrial applications
Mercon Regulator Co., 2357 N. 29th St., Milwaukee, Wisc.
Power plant specialties in regulation of pressure, level, rate of flow, proportioning & temperature
Meriam Co., 1955 W. 112th St., Cleveland, Ohio
Manometers, draft gages, indicating flow meters for steam, oil, gas, air, water, tank liquid level gages
Merkle-Korff Gear Co., 214 North Morgan St., Chicago, Ill.
Motorized speed reducers: induction, synchronous, reversing, d-c., universal motors
Merrick Scale Mfg. Co., Autumn St., Passaic, N. J.
Automatic continuous weighing machines
Merritt Engg. & Sales Co., Inc., 120 So. Niagara St., Lockport, N. Y.
Consistency controls
Meter Devices Co., 1001 Prospect Ave., S. W., Canton, Ohio
Electrical test devices
Meyer, Max, 76 Willoughby St., Brooklyn, N. Y.
Meyer Governor Co., 284 Baker Bldg., Minneapolis, Minn.
Long-distance recording, indicating, and contact-making instruments; gage pulsation protectors
Meylan, A. R. & J. E., 264 West 40th St., New York, N. Y.
Stop watches
M-G Gage Co., 107 Franklin St., Syracuse, N. Y.
Snap gages
Mico Instrument Co., 10 Arrow St., Cambridge, Mass.
Precision devices in industrial & scientific fields
Microchemical Service, 30 Van Zandt Ave., Douglaston, N. Y.
Microchemical laboratory apparatus
Micro Switch Corp., Spring St., Freeport, Illinois
Snap action switches
Mid-West Dynamometer & Engg. Co., Western Ave., at 60 St., Chicago, Ill.
Dynamometers
Miles Reproducer Co., 812 Broadway, New York, N. Y.
Microphones, sound recorders, amplifiers for industry.
Millen Mfg. Co., James, 150 Exchange St., Malden, Mass.
Radio test instruments
Miller Co., R. F., P. O. Box 455, Trenton, N. J.
Electrical testing devices
Miller Corp., Wm., 362 W. Colorado St., Pasadena, Calif.
Machine shop gages
Millers Falls Co., Greenfield, Mass.
Machine shop gages
Millios Radio & Television, 685 West Ohio St., Chicago, Ill.
Radio & allied testing instruments
Milwaukee Gas Specialty Co., 2025 W. Clybourn, Milwaukee, Wis.
Valves, fittings & safety shut-offs for gas fired equipment
Mineralac Electric Co., 25 N. Peoria St., Chicago, Ill.
Potential detectors
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.
Instruments for the detection, analysis & recording of toxic and combustible gases; instruments for sampling, counting & measuring dust particles
Mine & Smelter Supply Co., 1422-17th St., Denver, Colo.
Industrial equipment & supplies
Minneapolis Elec. & Construction Co., 80 South 12th St., Minneapolis, Minn.
Wire length measuring machines
Minneapolis-Honeywell Reg. Co., 2727 - 4 Ave., S., Minneapolis, Minn.
Heating, ventilating and air conditioning control equipment; thermostats; safety controls; motor and diaphragm operated valves; relays; furnace controllers
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Thermometers, hydrometers, etc.
Moist-O-Meter, Inc., Board of Trade Bldg., Kansas City, Mo.
Moisture testers
Moisture Register Co., 1029 N. Sycamore Ave., Los Angeles, Calif.
Moisture testing instruments & devices
Moline Furniture Works, Moline, Ill.
Laboratory furniture
Monarch Manufacturing Co., 3341 Belmont Ave., Chicago, Ill.
Radio set testers
Monitor Controller Co., Gay, Lombard & Frederick Sts., Baltimore, Md.
Electrical controllers
Morehouse Machine Co., York, Penna.
Proving rings
Morey and Jones, Ltd., 922 So. Hemlock St., Los Angeles, Calif.
Recording & indicating flow meters
Morse Twist Drill & Machine Co., New Bedford, Mass.
Gear testers
Mott-Smith Corp., 1505 Shell Bldg., Houston, Texas
Geophysical instruments
Munsell Color Co., Inc., 10 E. Franklin St., Baltimore, Md.
Color comparators
Muter Company, 1255 S. Michigan Ave., Chicago, Ill.
Radio & electrical products

N

Nashville Surgical Supply Co., 401 Church St., Nashville, Tenn.
Nathan Mfg. Co., 250 Park Ave., New York, N. Y.
Valves
National Airoil Burner Co., 1284 E. Sedgley Ave., Philadelphia, Pa.
Liquid level controllers
National Aluminate Corp., 6216 West 66th St., Chicago, Ill.
Conductivity meters
National Brass Co., 1600 Madison St., S. E., Grand Rapids, Mich.
Combustion & draft controllers
National Electric Controller Co., 5305 Ravenswood Ave., Chicago, Ill.
Rheostats
National Engineering Products, Inc., Commerce & Savings Bldg., Washington, D. C.
Pressure gage equalizers
National Instrument Co., 44 School St., Boston, Mass.
Electro-mechanical instruments & devices
National Meter Co., 4207 First Ave., Brooklyn, N. Y.
Water, oil & gasoline meters
National Research Corp., 100 Brookline Ave., Boston, Mass.
Optical products
National Scientific Corp., 2141 W. North Ave., Chicago, Ill.
National Technical Labs., 820 Mission St., Pasadena, Calif.
Beckman pH instruments and electro-metric pH equipment for completely automatic indication, control & recording of pH in large scale industrial processes
Natural Gas Equipment Inc., 541 Petroleum Securities Bldg., Los Angeles, Calif.
Furnace controllers
Negus, T. S. & J. D., 69 Pearl St., New York, N. Y.
Nautical instruments
Nelson Section Liner Co., 727 N. Seventh St., DeKalb, Ill.
Drawing instrument
Nelson Vacuum Pump Co., Geo. F., 2134 Fourth St., Berkeley, Calif.
High vacuum pumps
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
Liquid meters
Newark Scale Works, 10-12 Hobson St., Newark, N. J.
Scales
N. J. Laboratory Supply Co., 235 Plane St., Newark, N. J.
Laboratory supplies
New Jersey Meter Co., Plainfield, N. J.
Compressed air meters, separators for removing water & oil from compressed air lines, liquid flow indicators with low flow signalling circuit

N. Y. Laboratory Supply Co., Inc., 530 Broadway, New York, N. Y.
Laboratory supplies
New York Scientific Supply Co., 111 East 22nd St., New York, N. Y.
Laboratory supplies
Niagara Electrical Instrument Co., 727 Genesee Bldg., Buffalo, N. Y.
Electrical power analyzer
Nichol & Co., C. E., 4925 Lawrence Ave., Chicago, Ill.
Auto test equipment
Northern Equipment Company, 1945 Grove Drive, Erie, Pa.
Boiler feed control
Norton Co., Worcester, Mass.
Refractory laboratory ware, porous plates & tubes
Norton Electrical Instrument Co., 101 Hilliard St., Manchester, Conn.
Electrical instruments
Nürnberg Thermometer Co., Inc., 397 Bridge St., Brooklyn, N. Y.
Thermometers & Hydrometers
Nye, Inc., Wm. F., New Bedford, Mass.
Instrument & watch oils

O

Ohio Injector Co., 3 Main St., Wadsworth, Ohio
Check valves
Ohmer Fare Register Co., 740 Bolander Ave., Dayton, Ohio
Mileage recorders
Ohmite Mfg. Co., 4826 W. Flournoy St., Chicago, Ill.
Close control rheostats, fixed & adjustable power resistors, precision & non-inductive resistors, attenuators, tap switches and R. F. chokes.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa.
Testing machines
Omega Machine Co., 4010 Penn Ave., Kansas City, Mo.
Chemical feeding equipment for dry or liquid materials, by volume or by weight
Orton Jr. Ceramic Foundation, Edward, 1445 Summit St., Columbus, Ohio
Seger cones

P

Pacific Biological Labs., Pacific Grove, Calif.
Pacific Scientific Co., Inc., Bendix Bldg., Los Angeles, Calif.
Cable tension indicator
Pacific Specialty Co., 344 N. Vermont Ave., Los Angeles, Calif.
Palmer Co., 2501 Norwood Ave., Cincinnati, Norwood, Ohio
Industrial indicating "Red-Reading-mercury" thermometers & dial thermometers
Palo-Myers, Inc., 81 Reade St., New York, N. Y.
Laboratory supplies
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Timers
Park Sales Co., 3 Park Place, New York, N. Y.
Micrometers and calipers
Parks-Cramer Co., Fitchburg, Mass.
Humidity, heat & air change control, wet bulb temperature regulators
Parr Instrument Co., 222 52nd St., Moline, Ill.
Combustion bombs, calorimeters, hydrogenation apparatus, melting point apparatus
Partlow Corp., 2 Campion Rd., New Hartford, N. Y.
Temperature indicators & controllers, time delay relays
Pastor Shop Watch Co., 43 East Main St., Waterbury, Conn.
Stop watches
Patterson Screen Co., Towanda, Pa.
X-Ray intensifying & fluoroscopic screens
Paulson & Co., Henry, 37 So. Wabash Ave., Chicago, Ill.
Watch checking instrument
Paulstick & Sons, H., 2124 Fulton St., Brooklyn, N. Y.
Thermometers
Pauer-Sills Co., 4101 Ravenswood Ave., Chicago, Ill.
Vehicular counters
Payne Furnace & Supply Co., Beverly Hills, Calif.
Domestic & commercial gas controls
Penberthy Injector Co., 1242 Holden St., Detroit, Mich.
Liquid level gages
Penn Electric Switch Co., Box 556, Goshen, Ind.
Automatic controls for pressure, temperature, humidity, liquid level; also mechanically actuated unit switches. Specialized controls for refrigeration, air conditioning, heating, pumps, air compressors.
Perfex Corp., 415 W. Oklahoma Place, Milwaukee, Wis.
Automatic temperature controls for oil burners, stokers, gas burners, refrigeration & air conditioning
Perkin-Elmer Corp., 90 Broad St., New York, N. Y.
Optical instruments
Perkins & Son, Inc., B. F., Holyoke, Mass.
Testers for leather, paper & textiles
Permutit Company, 330 West 42nd St., New York, N. Y.
Indicators & recorders for CO_2, specific gravity of natural, manufactured or process gases, exhaust gas analysis, other uses where gas density guides operation
Petrometer Corp., 4 Star Square, Long Island City, N. Y.
Distant reading, liquid level tank gages
Pfaltz & Bauer, Inc., Empire State Bldg., New York, N. Y.
Laboratory control instruments
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Instruments for temperature indication, control & regulation
Phipps and Bird, Inc., Richmond, Va.
Laboratory apparatus & chemicals
Photobell Corp., 123 Liberty St., New York, N. Y.
Photoelectric equipment
Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.
Industrial photoelectric controls including counting equipment, electronic timers & special electronic controls, smoke controls
Photovolt Corp., 10 East 40 St., New York, N. Y.
Photo-electric elements, photometers, electronic timing devices, photo-electric colorimeters, photo-electric exposure meters, densitometers
Pho-Tron Instrument Co., 5713 Euclid Ave., Cleveland, Ohio
Photoelectric colorimeters
Physicists Research Co., 343 S. Main St., Ann Arbor, Mich.
Specialists in solution of unusual industrial research jobs, with special experience in machinery noise reduction, development of special instruments, & measurement of surface irregularities
Pickering Governor Co., Portland, Conn.
Governors
Pierce Watch Company, 22 West 48th St., New York, N. Y.
Stop watches
Pioneer Instrument Division of Bendix Aviation Corp., Bendix, N. J.
Aircraft instruments
Pitometer Log Corp., 206 Lafayette St., New York, N. Y.
Pitot tube flowmeters
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Gas & liquid meters, gas pressure regulators & accessories
Pittsburgh Instrument & Machine Co., 1026 Reedsdale St., Pittsburgh, Pa.
Brinell Machines, alternating impact machines, surveying instruments
Pittsburgh Taximeter Co., Point Bldg., Pittsburgh, Pa.
Vehicle recorders
Pneumatic Scale Corp. Ltd., Norfolk Downs Station, Quincy, Mass.
Packaging scales
Pneumercator Co., Inc., 307 E. 46th St., New York, N. Y.
Level indicators
Polarized Light & Photoelastic Co., 55 W. 42nd St., New York, N. Y.
Photoelastic polariscopes
Polarized Products Corp., 153-16 Tenth Ave., Whitestone, L. I., N. Y.
Polarization plates
Polarizing Instrument Co., 630 Fifth Ave., New York, N. Y.
Photoelasticity apparatus
Post Company, Frederick, P. O. Box 803, Chicago, Ill.
Instruments & equipment for architect & engineer
Potter Co., 1950 Sheridan Rd., North Chicago, Ill.
Automotive service instruments
Powers Regulator Co., 2734 Greenview Ave., Chicago, Ill.
Controls for air conditioning, temperature & humidity; also water temperature controls, dial indicating & recording thermometers & steam traps
Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill.
Recording thermometers & operation recorders
Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn.
Machine shop instruments
Precision Apparatus Corp., 821 East New York Ave., Brooklyn, N. Y.
Radio test instruments
Machine shop gages
Precision Gage & Tool Co., 320 East 3rd St., Dayton, Ohio
Precision Resistor Co., 334 Badger Ave., Newark, N. J.
Resistors
Precision Scientific Co., 1736 N. Springfield Ave., Chicago, Ill.
Standard & custom-built laboratory equipment
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.
Scientific instruments
Precision Tube Company, 3824-26-28 Terrace St., Philadelphia, Pa.
Fine tubing & metal shielded wire
Preferred Utilities Mfg. Corp., 31 West 60th St., New York, N. Y.
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R

Racine & Co., Jules, 20 West 47th St., New York, N. Y.
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Vickers Inc., 1400 Oakman Blvd., Detroit, Mich.
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W

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Wagner & Son, Carl H., 1944 N. Albany Ave., Chicago, Ill.
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Walker & Co., Geo. T., 324 Fifth Ave., South, Minneapolis, Minn.
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White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo. Furnace controls
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Williams, Brown & Earle, Inc., 918 Chestnut St., Philadelphia, Pa.
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Williams Gauge Co., 1620 Pennsylvania Ave., Pittsburgh, Pa.
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Willson Products, Inc., Reading, Penna.
Anemometers
Wilson Mechanical Instrument Co., Inc., 383 Concord Ave., New York, N. Y.
Hardness testers
Winslow Co., Inc., 9 Liberty St., Newark, N. J.
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Scientific instruments, optics, optical instruments, photographic products, polarizing instruments, precision meters, silent & sound motion picture apparatus
Wollensak Optical Co., 850 Hudson Ave., Rochester, N. Y.
Optical instruments
Woods "Lab. Apparatus", F. W., 140-6 Warden St., Pittsburgh, Pa.
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Woods Hole Oceanographic Inst., Woods Hole, Mass.
Oceanographic instruments
Worthington Gamon Meter Company, Harrison, N. J.
Liquid meters
Wright-Austin Co., 315 West Woodbridge St., Detroit, Mich. Power specialties
Wyland, George C., Center St., Ramsey, N. J.
X-Ray tubes & cameras

X

Xervac Instrument Co., 9 New Park Ave., Hartford, Conn.
Scientific instruments

Y

Yarnall-Waring Company, 102 E. Mermaid Ave., Chestnut Hill, Philadelphia, Pa.
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Laboratory supplies

Z

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Zernickow Co., O., 15 Park Row, New York, N. Y.
Tachometers, Tachographs, Tachoscopes, Quirometers, stop watches
Zip Abrasive Co., Center & Washington Sts., Cleveland, Ohio Tachometers
Zuhr, Inc., Henry, 187 Lafayette St., New York N. Y. Laboratory test instruments

MANUFACTURERS' NEW LITERATURE

In this department we report ALL pieces of NEW literature pertaining to Instrumentation, received from the manufacturers. Readers may secure without cost (unless noted) any or all items reported here, by filling out and mailing the coupon.

1-1 **Temperature Instruments for Electric Power Equipment.** Catalog, 7¾" × 10½", 32 pages, describes and illustrates "Micromax" instruments and their use for various electric power applications. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

1-2 **Du Mont "Oscillographer."** Vol. 4, Nos. 8 & 9, 4 pages, contains article entitled "The Cathode-ray Oscillograph as a Means of Demonstrating Elliptically Polarized Light" by Lawrence R. Steinhardt, Allen B. Du Mont Labs., Inc., 2 Main Ave., Passaic, N. J.

1-3 **Instruments for Measurement of Electronic Devices.** Booklet, 6" × 9", 16 pages, lists simultaneous vacuum tube voltmeter Model VG-11, microvolter, beat-frequency oscillator, signal generator, decibelometer, Model VG-6 vacuum tube voltmeter and audio spectrum divider. Televiso Products, Inc., 1135 North Cicero Ave., Chicago, Ill.

1-4 **Phototubes, Form PT-20R1,** 8½" × 11", 16 pages, contains complete information on phototubes and their applications for light-operated relays, color discriminating devices, automatic counters, for light measuring and for film sound reproduction. RCA Manufacturing Co., Inc., Camden, N. J.

1-5 **Industrial Analyzer.** Sheet, 8¾" × 11¾", 1 page, covers Model 77 a-c. power analyzer for complete power tests—3 phase, 2 phase and single phase. Measures values from ⅓ amp. to 300; watts from 15 to 240,000; voltages of circuits nominally 110-220-440-550. Niagara Electrical Instrument Co., 1 West Genesee St., Buffalo, N. Y.

1-6 **"The Story of Modern Industrial Weighing."** Broadside, catalogues complete line of scales—checkweighing, balancing, testing, counting, compounding and hand-weighing and their applications in industry. The Exact Weight Scale Co., Columbus, Ohio.

1-7 **Jet Pipe Regulator.** Bulletin No. No. 100A, 8½" × 11", 4 pages, describes and illustrates the jet pipe principle and construction and application of regulator. Askania Regulator Co., 1603 South Michigan Ave., Chicago, Ill.

1-8 **D-c Rectifiers.** Folder, 3⅝" × 8½", 6 pages, covers Model CR-2 for use on magnetic chucks, magnetic separators, pulleys and small d-c. motors; universal rectifiers in d-c. power capacities ranging from 400 to 1300 watts; Model M and three phase rectifiers. Mellaphone Corp., Rochester, N. Y.

1-9 **Radio and Electrical Test Equipment.** Catalog No. 124, 8½" × 11", 16 pages, introduces over 45 models of equipment, ranging from tiny pocket-type multi-purpose meter units, to large counter-type combination tube and set testers, including analysts, analyzers, trouble tracers, speed meters and highly flexible signal generator. Radio City Products Co., 88 Park Pl., New York City.

1-10 **Pyrometers.** Catalog No. 1101F, 8½" × 11", 32 pages, covers line of high speed photoelectric-action "Celectray" pyrometers, including indicators, indicating or recording controllers, recording and resistance thermometers; also price list. C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.

1-11 **Reading and Magnifying Glasses.** Folder, 8½" × 11", 4 pages, describes and illustrates line of reading glasses, magnifiers, loupes and photographic thermometers. American Thermo-Ware Co., Inc., 16 Warren St., New York City.

1-12 **Instrument Panelboards.** Bulletin 8¼" × 10¾", 4 pages, describes and illustrates line of instrument panels — self-supporting cubicle-type, flat plate panel with structural supports, standard unit panel with stock supports and braces, special type draft gage board, etc. Falstrom Co., Passaic, N. J.

1-13 **Apparatus for Checking Thermocouple Pyrometers.** Catalog E-33A-503.

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Please have the following catalogues, etc., reviewed in this issue sent to me.

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7¾" × 10½". 28 pages, describes and illustrates portable equipment for plant tests under actual operating conditions and laboratory apparatus to standardize it. Leeds and Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

I-14 **General Radio "Experimenter."** Dec., 1940, 8 pages, contains items on Radio Frequency Characteristics of Decade Resistors, New Dial Plate and Using the Variac at Low Frequencies. General Radio Co., 30 State St., Cambridge, Mass.

I-15 **Portable Electrical Instruments,** Bulletin P-10-1, 8⅜" × 10¾", 8 pages, covers d-c. Model P-11 permanent magnet moving coil type voltmeters, millivoltmeters, microammeters, milliammeters, ammeters and volt-ammeters; a-c. Model P-12 moveable iron type, a-c. Model P-13 rectifier type and a-c. Model P-14 thermocouple type; portable testing shunts and electric tachometers. The Winslow Co., Newark, N. J.

I-16 **Binocular Magnifier.** Sheet, 6" × 9½", 1 page, describes and illustrates "Bi-Mag" 2X magnifier with working distance of approximately 4", distance from eye to lenses is 1½"; frame of durable fibre with hood for shading and protecting lenses; head band is adjustable. Price included. John Unertl, 75-B Cemetery Lane, Pittsburgh (9), Pa.

I-17 **Hob Checking Equipment.** Bulletin No. 464, 8½" × 11", 4 pages, describes and illustrates "Sine-Line" lead checker for hobs, contour checker and hob sharpening checker. Michigan Tool Co., 7171 E. McNichols, Detroit, Mich.

I-18 **Adiabatic Calorimeter.** Bulletin No. E-60, 8½" × 11", 6 pages, covers adiabatic oxygen bomb calorimeter for determining the heat of combustion of any solid or liquid material that can be completely burned in an oxygen combustion bomb, including coals, petroleum products, foodstuffs, organic compounds and numerous other carbonaceous materials. Parr Instrument Co., Moline, Ill.

I-19 **Controllers.** Combined Catalog and Text Book, 8½" × 11", 84 pages, covers complete line of self-operated controllers, combined temperature controllers with indicators, pressure controllers, wide-range indicating controllers, wide-range non-indicating controllers and controlographs. American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

I-20 **Oxygen Recorder.** Bulletin No. DW-2, 8½" × 11", 2 pages, describes and illustrates recorder which measures and records oxygen content of process gases, excess air in products of combustion and air in gas transmission systems. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

I-21 **Temperature Control.** Bulletin, 8½" × 11", 4 pages, describes and illustrates "Econostat," an electric inside-outside temperature control system; includes typical operation chart and chart of methods of installation. Barber-Colman Co., Rockford, Ill.

I-22 **Immersion Thermoswitch.** Catalog Section 48, 8½" × 11", 2 pages, describes and illustrates thermoswitch, gives general specifications and lists prices. Fenwal, Inc., Ashland, Mass.

I-23 **Square Wave Analysis.** Folder, 8½" × 11", 4 pages, describes technique of analysis, shows figures illustrating square waves, low frequency cutoff, high frequency cutoff, transient oscillations and square wave modulation and covers Model 71 square wave generator. Measurements Corp., Boonton, N. J.

I-24 **Rotary Instrument Switches.** Bulletin SW, 8½" × 11", 1 page, covers Types "EN" and "BS" switches for instrument and industrial field; gives applications, construction data and general specifications. J-B-L Instrument Co., P. O. Box 135, Darby, Pa.

I-25 **"Bakelite" Molding Plastics.** Booklet, 8½" × 11", 32 pages, contains descriptions of compression and injection molding processes and explains essential differences between thermosetting (hot-set) and thermoplastic (cold-set) molding materials; physical, mechanical and electrical properties and characteristics of "Bakelite" phenolics, ureas, polystyrenes and acetates are enumerated in editorial and table form. Bakelite Corp., 30 E. 42nd St., New York City.

I-26 **Bore Checking.** Bulletin, 8¾" × 11", 4 pages, describes dial bore gages in standard, pistol-grip and vertical types, illustrations show gages being used to check inside diameters of aircraft engine parts; specifications and list prices included. Standard Gage Co., Inc., Poughkeepsie, N. Y.

I-27 **Burrell "Technical Announcer."** No. 40-117, 12 pages, contains articles on the interchangeable ground joint—a precision product in glass, lubrication of stopcocks, and a number of items on new laboratory equipment, including three-dimensional binocular microscopes. Burrell Technical Supply Co., 1935 Fifth Ave., Pittsburgh, Pa.

I-28 **Draft, Wind Box Pressure and Flue Gas Temperature Instruments.** Bulletin 33B2, 8½" × 11", 4 pages, covers two pointer type combination draft gage and flue gas temperature gage, three pointer type combination draft, wind box pressure and flue gas temperature gage, portable three pen recorder on 10" chart of furnace draft, flue gas temperature and wind box pressure, and two pen stationary and portable types recording draft gage and flue gas thermometer. Defender Automatic Regulator Co., 308 South 8th St., St. Louis, Mo.

I-29 **Manometers.** Bulletin No. 41, 8½" × 11", 1 page, describes and illustrates special types of double leg manometers for use as water or red oil gage or as a mercury gage. Prices included. Defender Automatic Regulator Co., 308 South 8th St., St. Louis, Mo.

I-30 **Rheostats.** Bulletin 1680, 7¾" × 10½", 6 pages, describes and illustrates "Jagabi Lubri-tact" porcelain tube rheostats for control of electric current in shop, laboratory and research work; metal cage types, screw-drive and switchboard types covered. James G. Biddle Co., 1211-13 Arch St., Philadelphia, Pa.

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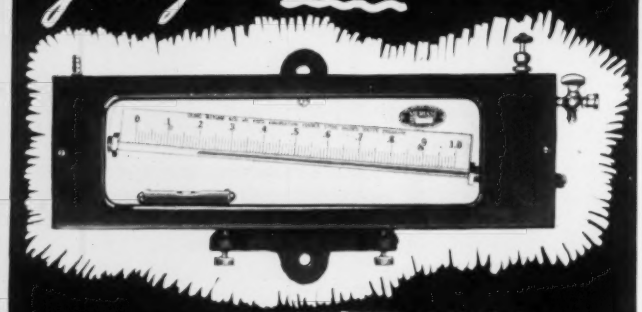

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Vol. 14 FEBRUARY 1941 No. 2

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